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JARGON APHASIA

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"I taught them the grouping of letters, to be a memorial and a record of the past, the mistress of the Arts and the Mother of the Muses".
'Prometheus Bound', Aeschylus.
Translated by Paul Elmer More

INTRODUCTION

In normal language systems in a given culture, a vocabulary and grammar are evolved whereby simple and complex action exchanges may be accomplished. When the dissolution of effective action exchanges results from disturbed syntactical structure of speech the phenomenon is designated as jargon aphasia. Such disturbed speech is commonly the result of vascular lesions and other types of trauma to a relatively focal region of the brain.

The language of jargon aphasia manifests itself as a verbal production that has lost its semantic transfer property as a consequence of a disruption of the *sequential ordering* of speech. The disturbance consists of word (syllabic), sentence and paragraph malformations, all in the milieu of rapid, voluble exposition. The individual words may be so distorted by the disarranged syllables that no useful information transfer is possible. In certain patients, however, words are properly generated; but the combination of words, because of reiterations, omission of connectives, admixture of unrelated contextual material, the use of improper substantives (paraphasia), and the omission of discursive stops, convey only variable degrees of information to the recipient. Concomitant with these major phenomena of jargon, these patients commonly exhibit difficulties in volitionally naming specific objects of the environment. They also evince variable degrees of inability to recognize the spoken word (auditory verbal dysgnosia). The quantity of useful exchange data is directly dependent on the intensity of the *disordered* verbalization.

Despite the obvious distortions of the evocative speech, detailed attention to nonverbal activities strongly point to a remarkable degree of preservation of the ideational processes. This is evident, even during times of most disordered verbal productivity, by the appropriateness of responses of the patient to varied social situations, by conventional adaptation to changes in the physical environment and by a general adherence to the major theme established in the "conversational set." In fact, even in the verbal medium, during intervals of reduced pressure for volitional expression, the individual may produce variable length fragments of well formed propositional speech which is wholly in keeping with the subject matter under discussion.

In this presentation it will be shown that there are three fundamental levels of clinical jargon aphasia. The first is a syllabic type in which the individual words (spoken and written) are distorted; the second basic type shows little or no individual word disturbances, but the phrase and sen-

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tence structures are sufficiently disordered to impede meaningful information transfer; in the third type words and individual sentences are well formulated but the paragraph loses its coherency; that is, the *expression* of thought sequences loses the contextual thread. Furthermore, by means of three typical cases it will be shown that the study of the pathophysiological condition of jargon aphasia forms a natural experiment whereby some insight into the relation between language processes and thought processes may be achieved.

CASE REPORTS: CASE 1

Case 1 is that of an uncommonly gifted 90 year old woman. She was said to have had a progressive deafness since the age of 54; this was ascribed to otosclerosis. Aside from this she had been in remarkable good health throughout her life, until in 1948, at the age of 85 years, she suffered a cerebral vascular accident which produced transient signs of left motor and sensory disturbance including left homonymous hemi-inattention to visual stimuli. After recovery from this episode she remained well for about three years when, following an interval of unconsciousness, findings referable to a lesion of the opposite hemisphere (left) were elicited. Subsequently the patient was subject to Jacksonian seizures which usually rendered the right upper extremity paretic for a variable length of time after each discharge. She did not lose consciousness during the uncontrolled activity. Following the second vascular insult she was observed to show an ever increasing volubility of unformulated speech, which was generally unintelligible to her listeners. On occasions she would become agitated and exhibit a lack of full awareness of the extent of her physical and language disturbances.

The patient was seen for the first time by one of the writers (R.C.) on August 9, 1952. Because of her deafness all communications were by written word. Her voice was high-pitched and unmodulated. There was little syllable or proper word ordering in general; however at times clear and contextually correct expressions were produced. It was remarkable to observe that although the verbalizations uttered had almost no transfer comprehensibility there was definite ideational integrity. This ideational integrity was abundantly manifest throughout the interview as exemplified in the following types of experiences. The query, "Are you a mathematician?" was written to her. These words were read aloud with syllabic malformations and interposition of irrelevant words; but she later said "No" in a pleased way, and then in a relatively well controlled voice stated "I am stronger in languages". "Sprechen sie Deutsch?" was then presented to her; she read the question aloud in unfamiliar random sounds, but withal she went to a shelf and procured a Bible written in German and began to "read" it aloud. As a further example of her at least transient general ideational intactness was her reaction when asked the geographical localization of a significant person. She responded in a voluble outflow of meaningless sounds and words. Seeing that the utterance made no impression on the examiner she went to a bookshelf and procured a World Atlas and proceeded to point to the general area where the individual in question was then residing.

At times, particularly when "relaxed", she would correctly read out loud all the words of a sentence except the key word. For example, when "Let me see you write" was presented to her, "write" was read as "reet" followed by an unintelligible group of sounds. Under these conditions she appeared bewildered and no attempt was made to carry out the requested operation. Some time later when handed a pencil she wrote the word "red". She had just previously seen a robin outside her window. When numerical tabulations and mathematical operations were written by the

examiner she was unable or unwilling to perform the requested arithmetic.

A sample of her handwriting[3] is seen in Figure 1. The handwriting has a graceful fluidity; it was performed rapidly. There is much "sound" association in the letter combinations as "koop, sook, look, and kice, kiss". Repetitions of letter combinations are prominent as in lines 6 and 7 (cap, face). The last five lines also show reiterative letter and syllable combinations. This sample is only part of six pages of such production. That the patient believed she was producing effective writing appears from the crossed-out letter combination in line 3. This writing is especially interesting in that, when not under too great pressure, it was incontestable that the patient was able to read and properly respond to much written material as attested in the above instances. Of course there were times, as noted, where no direct or delayed response was obtained to the written requests.

At one time she was asked to play the piano (at which she was adept prior to the manifestations of the cerebral vascular lesions); she exclaimed: "Oh, that is difficult", and then struck several chords; the notes were wrong, but the tempo was correct. Thus, in the sphere of music the defect in particularities (notes) appeared comparable to that exhibited in the verbal operations.

Once the patient stated that her voice was no longer sweet, and that it was loud and harsh. When asked (in writing) how she knew this, a torrent of sounds were emitted but no information was conveyed. Perceptual responses to auditory stimuli of any type or intensity were never elicited. The patient spent much of each day avidly reading the Bible in the English and German languages. Because of the apparent satisfaction derived, and the time expended in this Bible reading, it is believed that some order of "understanding" must have been achieved.

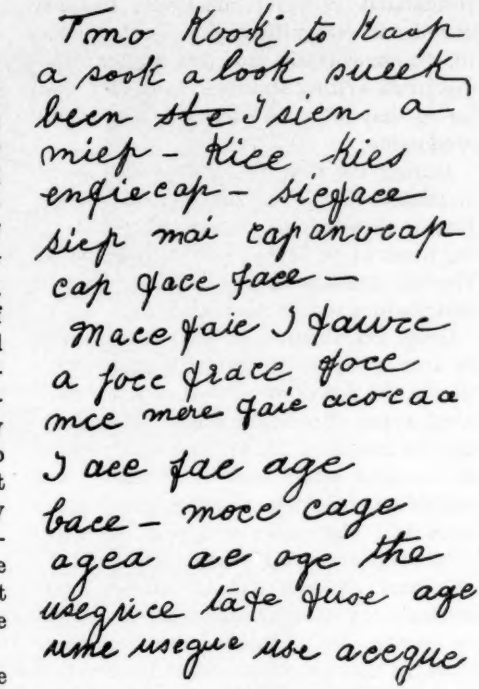

FIG. 1. Sample of handwriting of Patient 1

Furthermore the cultural ideation, as determined by the social graces (invitation to lunch, politeness) and the general adaptation to the examination situations, appeared reasonably intact. Great care was exercised to observe the adequacy of her visual acuity by presenting objects in the various fields and noting her ability to reach these objects. There was no evidence of a visual field or space preference. The observations pertaining to amnesic aphasia were difficult to evaluate as the patient never was at a loss for words to name the objects presented. But the word formation was such that most frequently it could not be recognized; at times however the names corresponded to the objects.

The clinical disorder may be summarized as deafness to all sounds; voluble, un-

[3] Obtained through the courtesy of Dr. E. A. Weinstein.

formulated verbal productions; transient disorder in recognition, or at least response to, the immediately produced written word; disturbed writing ability in a manner similar to that of much of the volitional oral production.

During the next year there was no remarkable change in the clinical picture. Death occurred in September, 1953, as the result of an acute respiratory infection. Visceral findings of the autopsy are not contributory to this discussion.

Gross examination of the brain showed an area of brownish softening in approximately the center of the left superior temporal gyrus (Brodmann's area 22 and extending into area 52, 41, and 42), (Figure 2). Another small area of softening was palpable in the left supramarginal gyrus (area 40). The cortex overlying the latter lesion remained superficially intact.

Coronal sections showed almost symmetrical, old hemorrhagic lesions severing the connections to each superior temporal gyrus. In the rostral section at the level of the optic chiasm, the left sided hemorrhage was represented by a brownish streak below the cortex. There were also small cystic lesions in the putamen and external capsule on the left. The right sided lesion extended from the ventral border of the putamen, following the contours of tangential fibers, slightly into the white matter of the temporal operculum. Thus at this level, the subcortex of area 22 was involved bilaterally.

The symmetry of the lesions was most apparent in the level illustrated in Figure 3A, a section through the plane "A" of Figure 2. The bilateral linear defects showed brownish discoloration of their linings; these defects followed the contours of the tangential fibers around the sylvian fissures between each insula and temporal operculum, thus isolating the medial geniculate bodies from the auditory receptive cortex. On the right at this level, the putamen, posterior portion of pallidum, external capsule and claustrum, were almost completely destroyed. The cortex was spared throughout the perisylvian region. On the left the more extensive hemorrhagic process had destroyed the medullary core of the transverse convolution of Heschl. The over-

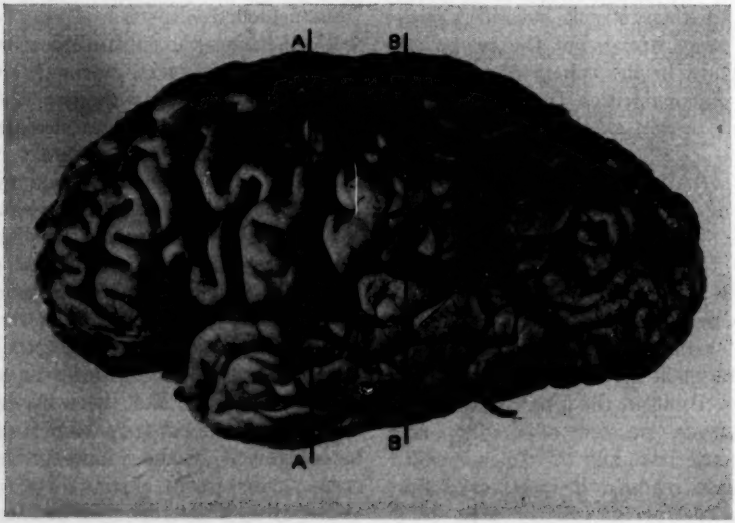

FIG. 2. Brain of Patient 1, indicating areas described in text

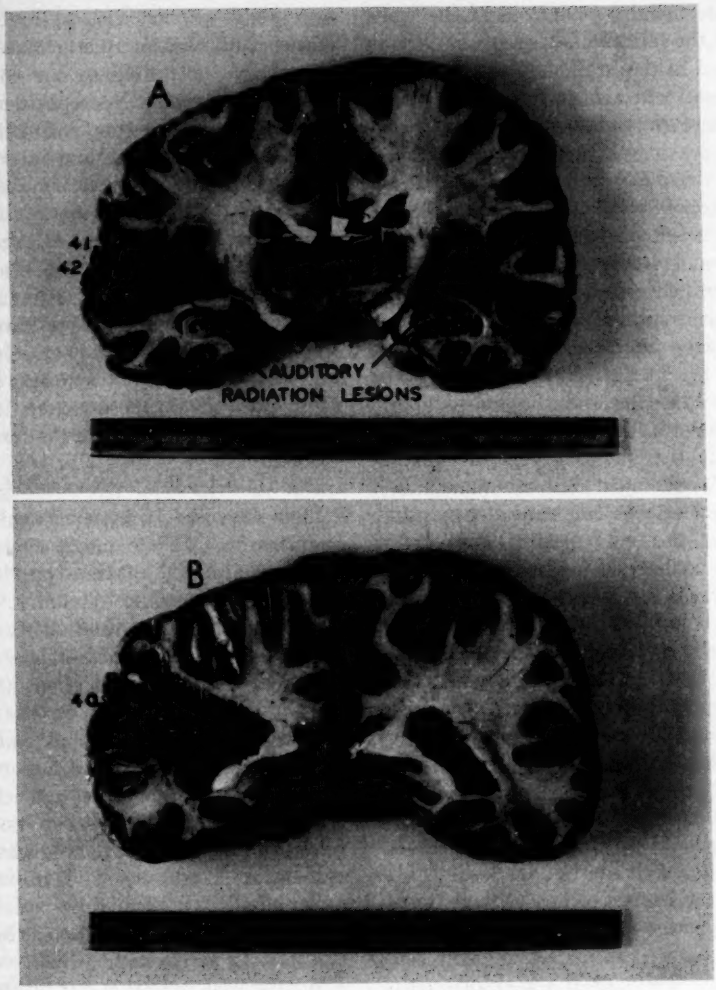

FIG. 3. Sections through planes indicated in Figure 2

lying cortex was soft, thin, and dark brown. There was slight involvement of the ventral insula and adjacent extreme and external capsules.

In a section through the plane of "B", Figure 2, the subcortical hemorrhage was observed to be much larger than had been suspected from the external examination. An almost quadrangular defect resulting from the bleeding had replaced the parenchyma between the posterior horn of the ventricle and the surface (Figure 3B), area 40, Brodmann. The subcortex of areas 22 and 42 was destroyed, and a portion of the geniculo-calcarine tract. The primary hemorrhage had probably occurred in this region; it was believed to be due to a rupture of a superficial branch of the middle cerebral artery. The lesions described in the rostrad levels were continuous with this area of softening.

Coronal sections caudal to this incision

showed only slight sponginess of the white matter of the left angular gyrus. No lesions were found in the brainstem or cerebellum. The internal carotid and middle cerebral arteries were markedly sclerotic bilaterally; the basilar artery showed minimal atheromatosis.

Microscopic studies, based on bilateral interrupted serial sections from the diencephalon and temporal gyri, will be only briefly summarized here. The gross anatomical observations as to the structures involved were confirmed; the lesions were obviously the sites of old hemorrhages. The auditory radiations and thalamo-temporal connections were destroyed on each side; on the left the auditory receptive cortex was severly damaged, but remained intact on the right except for some degenerative changes in the nerve cells. The medial geniculate bodies had lost practically all of their neural components (retrograde degeneration) and showed marked reactive gliosis. Extensive glial scarring had occurred around the central defects. Both lateral geniculate bodies showed variable degrees of impairment as represented by nerve cell loss and marked gliosis. This was of interest since the patient had shown only transient clinical evidence of visual disturbance.

Since the supramarginal lesion was clearly on the basis of a hemorrhage, histologic study was not carried out on this focus.

Brainstem levels of the auditory pathways were investigated but showed no significant changes. In view of the patient's age silver stains were made of the cortex; no argyrophilic or "senile" plaques were demonstrated. Many of the arterioles in the sections of various areas had thickened hyalinized walls; a few small thrombosed vessels were observed in the glial scars replacing the thalamo-temporal connections.

In summary, an elderly, exceptionally intelligent woman displayed, in the final two years of her life, a jargon type of speech and writing disturbance classified as *syllabic* according to the concept proposed in this study. Necropsy demonstrated the presence of bilateral symmetrical hemorrhagic lesions which had interrupted the auditory radiations, severely damaged the left transverse convolution of Heschl. and destroyed the subcortex of area 22 bilaterally. Area 40 left, was also involved in a blood extravasation. Although the patient was said to have been partially deaf for many years due to otosclerosis, the jargon aphasia did not manifest itself until after *both* hemispheres were affected in significant areas two years before death.

CASE REPORTS: CASE 2

This 49 year old man was said to have had three attacks of unconsciousness over a 6-hour interval of time on the first of August, 1956, while on duty in India. Following the third episode it was observed that he had a right hemiplegia, including the face, and a "central aphasia". He was seen by one of us (R.C.) for the first time on October 10, 1956. The patient was unable to walk, but appeared alert and indicated that normally he was left handed for all motor activities. The visual fields were full in single and double simultaneous stimulation; no visual hemi-inattention could be elicited. A minimal static flatness of the right face was observed, but in formal testing only slight weakness of this side was disclosed; this had a central distribution. Despite these minimal findings he showed an inconstant, but persistent lingual labial dyspraxia, even for mimicry. At first it was believed that his difficulty was the result of an inability to completely comprehend the spoken word, but with repeated testing under various conditions this explanation could not be sustained. The auditory acuity appeared normal. The tongue when protruded was in the midline. Taste and smell as far as could be determined were normal.

The right upper extremity showed a flaccid weakness, more intense in the distal elements; he was unable to move his fingers reflexly, or on request. Position sense was impaired in all fingers and the thumb on the right hand; but the wrist position could be accurately estimated. Vibratory perception was absent over the right hand, and impaired up to the level of the clavicle. Pinprick was normally perceived irrespective of the rate of application of the stimulus. Crude temperature testing elicited no abnormality. Number reading on the skin surfaces was appreciated in a normal way. All double simultaneously applied cutaneous stimuli were adequately resolved. Stereognostic function, with due allowance for a "naming" difficulty, was normal. A low amplitude, abortive wrist clonus was elicited; the deep tendon reflexes of the right upper extremity were slightly increased in amplitude, and the reflexogenous zones were increased in area.

The patient was able to stand and support himself with some assistance, but was unable to walk. In the right lower extremity the weakness was also most intense in the distal parts; he was unable volitionally to move his toes. The sensory perception was grossly similar to that in the upper limb, although the position and vibratory perceptions appeared less involved. The deep tendon reflexes were hyperactive on the right, but no definite Babinski sign could be elicited. Responses to bilateral double simultaneous testing were normal.

During the examination the patient spoke almost continuously. Each individual word for the most part was correctly formed; as estimated from a 30 minute phonograph recording abnormally formed words were approximately one in forty. Throughout there were only very short sequences of contextually correct word formulations. He seemed to recognize that his verbal output was of an abnormal type. This was clearly shown in the verbatim extracts of his verbalizations. He was asked: "Where were you stationed?" The response (transcribed from the disc recording): "It began with a ditto. I don't get those while I think the quoted things, the women were hurt ladies that's too (two?) left. All I can say they caught 3 hours at 9 o'clock. Later date date later of the dato men and women were hurt through I can't connect. When I take it off like that the only they, they don't carry enough the they is they said, they said they specialized NATO from it 6 and 6, 6, 9 o'clock rather duration was 6 hours. From it source and that's the way they picked me up".

To the question "From what school did you graduate?", the response was: "I was waking there, that was a long time ago, Chicago. They don't say that very nicely hold it off might come without connection hear it like, Chicago. I can tare, tell. I know exactly. Will come in erraction and not in suraption and Chicago, and that is the Hell of it".

To the first question it is obvious that he was trying to describe the onset of his illness. To the second question he was trying to impart the information that he had attended the University of Chicago (which was in fact the case.) He also was trying to explain and describe the nature of his language disturbance. It is interesting, as brought out by later questioning, that he felt that he did not always know exactly what was being said to him. It was clear that when single words like cat, dog, man, ice-cream, were presented he knew their meaning, and could easily repeat them after the examiner. But if asked to repeat "The Lord is my Shepherd", he said: "The man and, there I go, the cat". When repeating the words to the anthem "America", he was quite accurate as long as each word was presented singly and slowly with a long space between each word; just as soon as even three words were presented in their normal tempo this ability to repeat was lost.

In general as he became more aware of

his faulty output he would accelerate his verbal productions; and it was at these times that the syllable distortions were more frequent. One sensed that the auditory apparatus, for communication purposes at least, was overloaded.

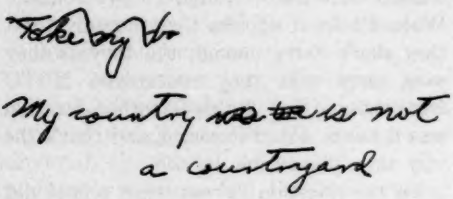

FIG. 4. Patient 2; dictation of "My country 'tis of thee".

FIG. 5. Patient 2; calculations and human figure drawing.

He could point to objects of the environment correctly when they were named singly. If several objects were presented in rapid succession he failed in this type of operation. This was particularly evident if the classes of the objects were not clearly distinct; he could hardly differentiate shades of colors, or the difference between a jacket and an overcoat.

In reading he spontaneously skimmed, and produced words that were not in the printed matter; he omitted several words or even phrases. When the production was rapid the words were malformed. However, when each single word was painstakingly pointed out by the examiner, or when necessary, blanked out, the words in a sentence were read with no mistakes; an entire page from a children's book (Rudolph the Red-Nosed Reindeer) was read correctly in this manner. Later when he tried to show off his new found ability to another physician he failed miserably, as he was unable to isolate the words without assistance. He could not carry a tune, nor could he accompany the examiner in humming a tune.

In practic function he was able to reassemble a flashlight. Spontaneous writing could not be accomplished; however to dictation he produced the material shown in Figure 4 when asked to write "My country, 'tis of thee".

Calculations (multiplications) were operationally, but not arithmetically correct (Figure 5). Of geometrical forms he was able to spontaneously depict a straight line and a circle but not ellipses or triangles. His picture of a person was grossly symmetrical, multilined, and the extremities were loosely coupled to the body (Figure 5). The EEG showed maximum slow activity over the left frontal and temporal derivations.

During the course of the extended interviews he indicated that he was married to a Viennese girl, and that they had two children, aged five and three years.

At all times he seemed painfully aware

that he was badly hurt; there was no element of the process of illness denial. It was also clear during the examinations that this man was properly goal directed, that his inner being was not nearly as confused as were the "external manners of lament".

Following this study the patient was introduced to speech therapy techniques. On re-examination about six weeks later, he still showed many of the phenomena presented previously; however there was better timing and therefore less tendency to jargon production; but as he became excited and wanted to impress the examiner by his progress his evocative speech deteriorated to the earlier observed level. In subsequent months the volitional speech improved considerably, but with the pressure of immediacy, regression to jargon output was experienced.

At the time of this writing the patient retained residuals of his speech difficulties. There had been no progression of his deficits. It is believed that he had a vascular lesion.

In summary, a 49 year old, left-handed man had a sudden onset of a right hemiplegia, including the face. A jargon aphasia, classified as a word order type was also observed from the onset of the disturbance. Electroencephalograms showed abnormal activity over the left frontal and temporal derivations. There was a slow, progressive recovery of both the physical and language functions. The impression is that the defects resulted from occlusion of branches of the left middle cerebral artery involving the motor projection and temporal regions of the brain.

CASE REPORTS: CASE 3

This 25 year old, single man had approximately seven years of military service. He spoke rapidly in a well modulated voice at the time of the initial interview, a few days after his hospitalization on November 4, 1952. He had been subject to recurrent "dizzy" spells and intervals of blurred vision during reading. The dizzy spells were described vaguely as "a strange feeling in my head"; "like a faint"; "no, it isn't, it is a dizziness in my head". During the dizziness he believed that "things seemed quieter than usual", although he denied any vagueness, unreality, time distortion, unusual body feelings, or déjà vu.

He was left handed in all of his major motor activities. Aside from a diminished face muscle display during volitional activity, detailed neurological examinations revealed nothing abnormal. On repeated testings, the electroencephalograms showed a definite slow activity over the left temporal region.

On April 17, 1953, the patient had a nocturnal seizure. The relative immobility of the face muscles seemed more prominent after this episode. Again gross neurological testing gave responses that were within normal limits. Spinal fluid examinations, two arteriograms, and two air studies failed to confirm the focal left temporal electrical abnormality. Following these procedures he seemed less spontaneous in speech as well as in other motor activities. He also noted an increase in the sound intensities of the environment ("more treble"). The frequency of the seizures increased. Medication did not influence the convulsive phenomena. Since the clinical neurological and laboratory tests, with the exception of the EEG were unrevealing, the patient was placed on the retired list with the diagnosis of epilepsy.

In July, 1955, he returned to the hospital for further study and reevaluation. His memory and general orientation were intact. He indicated that he still had "blackouts" and dizzy spells, and that these were occurring more frequently. Despite the seizures he was working on his father's farm; when he felt "sick" he would stop working for a short while. He stated that he had never seriously injured himself during the seizures. The electroencephalogram still showed the left temporal electric ab-

normality, and more generalized slow activity was also observed. It was noted that he now had convulsive automatisms: These were initiated by an "off-tune hum", followed by copious salivation together with inappropriate complex motor activity and slurred, reiterative verbal production.

The other clinical neurological tests continued to yield no positive findings. Air studies now, however, showed ventricular distortion. A craniotomy was therefore performed and the anterior 7½ cm of the left temporal lobe was ablated to remove an astrocytoma which displaced and infiltrated the brain substance in this region.

The patient was interviewed about three weeks later on his ward. He recognized the examiner (R.C.) and said, "Hello, I know you", but he could not recall the name. He stated that he had a very severe headache, but prior to allowing him to sleep, it was observed that he could not name objects of the environment. His volitional speech was halting and his vocabulary was limited.

On August 23, approximately one month post-operatively, the patient appeared alert and eager to converse. In "small talk" the conversation was entirely adequate. In answer to "How are you?", he said, "I feel so much better. When I saw you on the ward the other day I had such a bad headache. I can walk now; I walk around upstairs all the time now". His vocabulary did not allow him to discuss his operation, but by gestures it was obvious that he was happy that the surgery had been performed. He thanked the examiner repeatedly for this interview. He further remarked: "I hope that your *hand* gets better soon". (R.C.'s hand was heavily bandaged because of a burn). Despite this large amount of friendly verbalization, and non-volitional naming ability, he was unable to name any common object presented to him. Because it was observed that if several things were presented simultaneously he became unable to utter even a sound, isolated objects were placed before him. This barely improved the specific volitional naming performance. When shown a comb he could not name it. At first it seemed that he did not understand the request. After the word "comb" was repeated several times he was able to say "comb"; but the retention of the word, even without the interposition of new substantives, could be retained for no more than four or five repetitions. Contrary to certain patients, who in the absence of the ability to name an object, can not use it, this patient was able to use the comb in an entirely proper way. In repeated testing it was observed that he could not retain the memory of a word (for recall) for longer than 20 seconds; usually the recall and naming memory was limited to even shorter times. In testing color naming and recognition he often responded with "longer" for yellow". He found "red" easier to repeat and remember. However when asked to write "red" he was able to produce "re"; he could, and did say "d", but was unable to depict it on paper. In further writing attempts he could only produce his first name.

When $\frac{4}{+2}$ was written he was able to correctly carry out the arithmetical operation. For $\frac{9}{\times 3}$ he performed addition: first he wrote $\times 10$, and when questioned as to its correctness, designated the answer as $\times 12$. For $\frac{12}{2}$ he produced 2. In performing these operations he counted aloud to himself. His drawing of the human figure required 20 minutes to execute; it was normal in symmetry and form.

The patient was completely unable to lip read; he only recognized words when he "heard" them. On request to sing, no recognizable tune was emitted. Further neurological examination revealed a right homonymous upper quadrantic visual field defect, together with an extreme paucity of spon-

taneous motor activity, particularly of the face muscles.

In subsequent interviews concerted efforts were made to teach him to read by manual kinesthetic methods, but his general reading ability was not greatly furthered. He learned to match colored objects with the appropriate written names of the primary colors. Again the patient's ability to carry on a social conversation (manifested by such spontaneous remarks as "I am glad your hand is getting better", and "I hope that you have a nice week-end") highlighted his overwhelming difficulty in naming objects, in reading and in writing. Subsequent to this series of examinations, the following note was made: "It is interesting that despite the visual and auditory verbal dysgnosias, no jargon output is observed."

Over an interval of several months, before the patient returned to his home, the general language function slowly recovered so that he achieved moderate reading and naming ability.

On January 23, 1957, approximately 18 months after the last formal interview, the patient walked unaccompanied into the examination room. He remembered the examiner. He was oriented in all spheres, and readily named the President and Vice-president of the United States. He was also able to name most of the common objects of the environment, but paraphasic words such as calling a pair of eyeglasses a "flashlight" were sometimes uttered. The general speech was voluble and remarkably circumstantial; particularly when related to non-personal subjects.

The following examples of the patient's verbalizations were excerpted from disc recordings:

Q. "What do you do all day?"

A. "Where at? You mean what do I do at home every day? We work on the dairy farm and my younger sister going to school so I try to be up early, along accordingly. So that we have more than enough to rush or anything like that. I feel good, mother, dad. It is very interesting, now that I have more time at home it is quite a difference of a change of course. I knew what it would be like, and so far as staying there I like it very much, but the same as here or anywhere."

Later, after he had been talking about things in general for some time, the patient repeatedly brought up the idea that he couldn't accept certain things. On this basis the question was asked: "What can't you accept?" The reply: "The only thing that bothers me the record of what's bothering me when I eat. I have no trouble, but I can tell you almost the different times when I feel coming on to start getting a little dizzy. Very few times I passed out in the last year again. And I couldn't say the length of time, but there is a lot in between and it doesn't matter, indoors, outdoors, if I'm tired, or feel good. It is the part that I eat or smell. The same. I can't eat an orange and ginger snaps, smell smoke, sausage, but bacon, yes."

The general idea seemed clear that he was disturbed by seizures that appeared to be triggered by smells. As noted below, this phenomenon was investigated in some detail.

In more abstruse material the continuity of ideation was much less coherent than in the above types of discussion. *Q.* "What do you think of Mr. Eisenhower's Middle East Policy?" (This was very much the topic of conversation at the time of the interview). *A.* "Well if you want to sit down and talk with some one about that so I think it's wonderful for a change if nothing else it will be of value to improve something regardless of the price because it is a change, but I think he's got a good one". *Q.* "What is the policy?" *A.* "The doctrines make all the countries independent, each one, just like if you ask, now to anyone for help up to a certain percentage yes, not again, even though it is going to take us into; if you were in Europe and were next

to the countries they have been there so long that there is a mess of people, but they are not happy, same as in U. S. Depends on the governor and how they are taking care of the people. We can make guarantees regardless of what they ask for. Eisenhower has a good background in World affairs, has been all over. Yes, he's been through a lot. Now he has four years back of him, and with the second election now; the next four years I think will be a lot different".

His picture of a person was distorted. He knew right from left and was oriented in space. When presented with the problem:

$$\begin{array}{r} 879 \\ \times\ 97 \\ \hline 5946 \\ 7821 \\ \hline 84156 \end{array}$$

the operation of multiplication was correct, but he did not remember the "tables". He read from "Rudolph the Red-Nosed Reindeer" with many mistakes; *wake* was read *make*, *throughout* for *thought*, *Randolph* for *Rudolph*, etc. He could not remember what he had read.

On this examination olfactory acuity was normal in formal testing. He believed however that certain odors caused him to have "dizzy" spells, and even unconsciousness. Because of the apparent triggering of convulsive activity by olfactory stimulation, certain agents that he described as noxious, such as oranges, peanuts, ether, and cigarette smoke were brought into his presence. During this testing his eyelids were maintained closed. In a random way noxious and innocuous materials were placed in the olfactory perceptual fields. He invariably recognized the noxious substances and nearly always indicated that he became dizzy, but at these times there was no clear electric concomitant; *i.e.*, the basic abnormal electrical output was not specifically altered. This type of olfactory testing was carried out continuously for over two hours.

Perimetry again demonstrated the right homonymous quadrantic field defect. In careful single confrontation tests in daylight no clear visual field defects were elicited but with double simultaneously applied visual stimulation there was repeated failure to recognize the object in the right temporal field. The right pupil was 4 mm in diameter, and the left 2.5 mm; each iris muscle responded to light and in convergence. All the other pairs of cranial nerves showed normal function. All motor and sensory responses of the extremities and torso were adequate. This included gait, strength and coordination in the effector elements; pinprick, temperature and touch perception (the latter including double simultaneous bilateral and ipsilateral stimulation), position sense and number reading on the skin surfaces, in the afferent systems. The superficial and deep tendon reflexes were active and equal. No visceral complaints were elicited.

The electrical abnormality was more intense and of greater areal extent than at any time subsequent to surgery. It was believed that this signified an extension of the tumor growth, but this could not be confirmed by other studies.

In summary, a left-handed 25 year old man who showed an abnormal electric activity in the left temporal region, was found to have an astrocytoma in that area. The tumor containing anterior part of the temporal lobe was ablated. Following surgery a nominal (amnesic) aphasia was transiently observed. Later, with good recovery of naming ability a sentence order jargon aphasia became manifest. Because of continued olfactory induced seizures and because of the generalized increase in slow activity of the EEGs an extension of the cerebral neoplasm was suspected.

DISCUSSION

At its most complex level, language may be viewed as a means whereby goal directed, social adaptive and appetitive func-

tions are performed. Under these conditions when an element of the instrumentalities is rendered non-functional by lesions of the brain, the relatively intact components of language must be reorganized to affect a continuation of the general communicative processes.

At a pragmatic level, language may be analytically approached directly through the instrumentalities of the receptive, elaborative and executive functions. In the domain of the instrumentalities it is important to determine the primary, particular component of the total constellation that has become impaired in its function to disturb the entire communication apparatus. This type of study has resulted in the classical clinical-pathological correlations of the neurological literature; furthermore this method has logically generated the idea of strict localization of brain function to discrete areas of the cortex. On this basis, the analytic study has been recently subjected to criticism.

In our presentation the analytical pragmatic method appears most fruitful, but language is at all times recognized to have a function independent of the mechanics of any single element of the speech apparatus.

Case 1 is representative of a disturbance of *syllable order*; case 2 shows a typical disturbance of the *word order*; and the third case demonstrates a disturbance of the sentence (*textual*) *order*. Thus, the factorial component in the clinical jargon aphasias is the disturbed *order* of evocative speech. These three major levels of order disturbance form the primary semiology of jargon aphasia. Certain cases show elements of all three levels of disorder, but in any case a single level of disturbance is dominant.

In verbal communication the syllable constitutes the basic element of expression. This is in consonance with the rhetorical treatment of the syllable as the carrier unit of language (22). Not only does the syllable assist in the transfer of semantic data, but because of its melodic property, it conveys feeling tone and thereby contributes to the establishment of the proper milieu for information exchange purposes. That the syllable represents a biologically determined phonetic unit may be further derived from the early Egyptain hieroglyphic and early Sumerian cuneiform characters. In these writings each symbol represented a complex sound (syllable) and not a single phonetic equivalent as in the alphabetic representation.

Because of the basic nature of the syllable, when word (syllable) malformations are predominant in the jargon aphasia it may be inferred that the garbled language produced is representative of maximum degradation in the evocative sphere. Consequently the word order and the sentence order disturbances appear to represent progressively less dissolution of basic language function than does the syllabic disorder.

Alajouanine (1) described *undifferentiated*, *asemantic*, and *paraphasic* jargon as different types of jargon aphasia. In our formulation the undifferentiated and asemantic types of Aljouanine would be included under syllabic jargon, since the "neologisms" represent disordered syllable combinations in the same sense as that of the undifferentiated jargon. The paraphasic jargon is encompassed in our word order jargon. In each instance although the individual words are properly formed the sentence structure is malformed; this grammatical disarray results in defective syntactic style. Alajouanine apparently does not recognize the type of jargon resulting from sentence order disturbance as represented by our Case 3. As illustrated in this individual, the coherency of expression sequences are distorted and the logical transfer of information is impaired. Our classification has the merit that it is based on the primary elements of language: (1) The syllable combinations forming words which act as the unit carriers of thought. (2) The word grouping which is in the realm of the grammarian. (3) The sentence grouping, or

paragraph, which forms the unit of the plan, the realm of the logician.

It is incontestable that many individuals exhibiting jargon aphasia can not *entirely* recognize that their written and spoken verbal productions are unable to transmit information. This fact is elegantly shown in the crossed-out letter groups in the written productions of our Cases 1 and 2 (Figures 1 and 4), where "corrections" were made in writings that had no grammatical structure and consequently were devoid of ability to transfer information. It is equally incontestable, however, that nearly all individuals exhibiting jargon output, to variable degrees are aware of their defective verbal communication. This is clearly demonstrated in the second and third cases presented; even in Case 1, the inability of the auditor to respond in an intelligent way to her verbalizations resulted in repeated increased volume of words, increased general motor activity and obvious anxiousness. Head's patients with syntactical aphasia were also aware of their difficulties (7). This was particularly striking in his case 14. This individual was an officer whose speech consisted of "most extraordinary jargon"; during this type of verbal production, when it became obvious that he could not make known his wants, he was driven "into a fury". Anger reactions occur frequently in such patients and appear to be an expression of the "catastrophic" response of Goldstein (6).

The remarkable ability of individuals with maximally degraded ordering processes of evocative language function (syllabic jargon aphasia) to perform appropriate actions when requests are written or spoken, forces one to consider the role of ordered language in thought processes.

Since all behavior (adaptation to change in the set) is language in its most general form, it seems clear that verbal language is but *one* element in the array of evocative language. This one aspect is primarily involved in the disturbed order process designated as jargon aphasia. On this basis it follows that one should not necessarily find that all evocative language function is equally disturbed in patients with jargon aphasia.

The verbal output has sometimes been considered the prime expression of "inner thinking" processes. This derived from the fact that the verbal evocative speech function has become the paramount, and a most economical, communication modality of man. Consequently when evocative verbal language fails, the reconstitutive adaptation with other modes of evocation are slowly and incompletely organized. Hence as a result of a failure to closely observe the non-verbal evocative elements of speech, such expressions as "internal and external" jargon have been used (23). Operationally all evocation is the result of elaborative brain processes, and therefore, internal. With this point of view in mind it becomes correct to describe each class of evocative language (verbal, gesture, painting, etc.) as an entity; each with its characteristic type of action and disturbances of action.

Treating verbal evocative language as an entity it seems important to determine if this type of speech is the primary control of directed behavior; or if it is more properly a handmaiden to goal directed conceptualized behavior. Surely man scratched his head before he evolved the name of head, or was able to describe the operation of scratching; also man must have sought shelter from the weather before the concept of rain was described in language forms, and even before he developed a sign for rain, sun, etc. Thus personal actions and reactions must have been initiated without the guidance of speech. But with the development of inter- and intra-society communication, language must have been shaped, and in turn must have shaped the actions of the participants. There can be little doubt that there is a reciprocal operation between a given culture and its instrument of communication, language. Whorf (21), in *Lan-*

guage, Thought, and Reality, espoused the concept that language was a primary determinant of man's actions, *i.e.*, man's ability to observe and to respond to his observations was dependent to a high degree on the language form in which the patterns of observation were made. This idea implied that language forms the skeleton upon which observations and actions are made and executed. In essence this is a specific statement of the earlier general "pseudomorphosis" concept of Spengler (20); where man's behavior is influenced and controlled by the physical environment in which the action takes place.

Einstein (5) stated the problem succinctly when he wrote, "We might be inclined to attribute to the act of thinking complete independence from language if the individual formed, or was able to form, his concepts without the verbal guidance of his environment. Yet most likely the mental shape of an individual growing up under such conditions, would be very poor. Thus we may conclude that the mental development of the individual and his way of forming concepts depend to a high degree upon language. This makes us realize to what extent the same language means the same mentality. In this sense language and thinking are linked together".

The extent to which evocative verbal language influences clinical behavior is exemplified in certain patients with brain lesions who are unable to name common objects volitionally. These particular patients can not use the object (comb, watch, pencil, etc.) even after the name has been given them by the examiner; only after they "sound" out, or pronounce the name themselves can they carry out the appropriate action. Another instance is in the developing language function of children. It is clear that children *see* what experience (repeated observation and training) says is there; their experience and consequently "seeing" appears to be primarily a process of acculturation. It is the concomitant interrelation between observation and language that so interminably welds these two phenomena. But through the study of the jargon aphasias one sees that all behavior (therefore all language) does not disintegrate with dissolution of the ordered verbal evocative processes in spite of the remarkable impairment of information transfer.

Another set of observations indicates that many patients showing "isolated" amnesic (nominal) aphasia, when attempting to name an object will utilize disordered phonemes. It is interesting, as shown in some of our cases, that in many volitional declarative expressions these same patients may utter entirely intact phrases. As examples: "I am 46 years", "Yes that is so". But these same patients when asked to name a pencil or other common object of the environment will generate non-recognizable sound combinations. The majority of patients who show an "isolated" nominal aphasia do not have volubility of speech output, in fact these patients tend to remain quiet; the jargon quality of the evocative speech must in most cases be elicited, as the more usual adaptive mechanism is to utilize a word of the general class, or to demonstrate the object's use, or by some other circumlocution. We believed at first that these patients with "isolated" nominal aphasia refrained from "jargon" because they realized (by their intact hearing control apparatus) that their proposed sound combinations were inadequate for communication purposes. However, further observations showed that some patients with "isolated" nominal aphasia, who retained normal auditory perception, *did not* refrain from the production of syllabic jargon when called upon to name objects. This fact has forced us to the conclusion that the disordered syllable production in patients showing nominal aphasia is fundamentally similar to that generated by patients showing jargon aphasia.

In the works of many authors the syntactic disturbance symbolized by agrammatism is treated in the class of jargon apha-

sia; in fact agrammatism is used as a synonym for the syntactic (jargon) aphasia by some investigators (12, 24). In our experience it appears that agrammatism may express itself in at least two different basic forms. One is the telegraphic style which is frequently observed in individuals who have retained only a limited vocabulary, as the result of brain lesions which involve either the major frontal (Broca's area) or the dominant angular gyrus. The other form is what we consider "true" agrammatism in the sense that there is an abundance of words, but the grammatical structure is disordered. It is this latter type of agrammatism that is clearly an important component of the jargon aphasias. Pick (19) believed that agrammatism should not be considered on the same level with paraphasia and higher grades of jargon aphasia. We believe that this is a matter which concerns the basic working hypothesis of the jargon process. Thus when syllable combinations are so distorted that they can not be recognized as words it is of course fruitless to talk about grammar. When words are disordered to the extent that the relation between subject, predicate and their modifiers can hardly be determined, agrammatism is a proper designation; but this type of sentence structure is precisely our second type of jargon aphasia! When grammar is distorted as in our type three jargon aphasia, the proper symbolization should be dysgrammatism. Consequently considering jargon aphasia as a graded process of disordered evocative verbal language, agrammatism follows as an indissoluble and essential element of the jargon syndrome.

In the Hixon Symposium of 1949, Lashley (10) discussed jargon aphasia in his characteristically detailed manner. He indicated that syntax may be generalized as a temporally dispersed serial ordering phenomenon, where each element in the series supplied excitation for the next. He suggested a hierarchy in which there was an ordering of vocal movements, words, sentences and paragraphs in discourse. He also suggested, as Head did earlier, that there might be a primary disturbance in rhythm. We believe that all these factors play important roles, but that the *unique* serial disordering of the syllabic sounds, and their derivatives, comprises the major element in the jargon aphasias.

If phonetic verbal function may be idealized to encompass only the auditory processes it appears possible to derive a mechanical model that might reproduce the elemental phenomena observed in clinical jargon aphasia. This idealized model consists of *two* parallel *memory* devices (like two magnetic tape recording and playback systems). This is necessary because in normal brain auditory memory and recall processes, *each* temporal cortex must receive primary data in parallel. If it is assumed: (1) that the two sets of auditory data are "memorized" in the temporally ordered way of reception; (2) if in ordinary recall, synchronization of the outputs of both devices is achieved, or instead, if one system can inhibit the action of the other; and (3) that one system may act as a pacemaker, then we can discuss the conditions under which the reproduced "memorized" order may become scrambled.

When the pacemaker recall function is impaired by reason of injury to the memory carriers, and/or the synchronizing connections to the parallel number two system, then a scrambled, disordered output must result. The intensity of the scramble would appear to be a direct function of the degree of *interaction* of the damaged and relatively intact devices.

In the light of such a model it appears that certain specific clinical data become clearer. As has been abundantly shown in neurological practice, volitional demands repeatedly worsen the evocative jargon speech. From the formulated model this would indicate that sentiency sets into operation the malfunctioning mechanism so that maximum influence is exerted; that is, by

volition the impaired modality unit is forced to generate maximum output and therefore deleteriously modulates the relatively intact system, so that increased jargon is manifest. The seeming perfection of non-volitional speech would find explanation in the use of only the number two system when it is unmodulated (or uninfluenced) by the impaired system. The apparent disturbances in rhythm, and hierarchial order changes would represent secondary phenomena.

Such mechanistic models, although not specifically stated, are implied in the clinical expression of "the other side takes over". Thus Maas in 1920 (12) argued that agrammatism was the result of the imperfectly equipped right hemisphere essaying the function of speech when the speech areas of the left side are destroyed by large lesions. Our mechanistic formulation is in excellent agreement with Nielsen's clinical observations (17). Nielsen explicitly stated that a lesion of the dominant speech area in one hemisphere might be responsible for the deleterious function of the homologous area in the intact hemisphere. On this basis Nielsen first advocated the ablation of the involved speech area to effect clinical amelioration of the clinical disturbance (18).

Jargon aphasia as discussed, is primarily an evocative language ordering disturbance and not necessarily a phenomenon involving all ordering processes of the brain. In certain schizophrenic patients who show volubility of speech, "neologisms", and little basic contextual integrity, there is a superficial similarity to jargon aphasia (4). It appears that the primary differentiation between the two conditions is accomplished by observation of the obvious effort expended by the brain-injured patient to transmit his ideas, by the intensity of his productions, and by the chagrin when he is aware that his ideational data transfer has failed. The schizophrenic patient on the other hand, appears pleased with his verbal output; he expends no particular effort to amend and edit his verbalizations. In general he acts as if instead of transmitting ideas, he is utilizing words to obfuscate his ideational activities.

In the logical formulation of language as portrayed by Carnap (2) and Morris (16) a basic three-class system is established. These classes are: pragmatics, semiotics, and syntactics. Pragmatics comprise the *effect* of language on the speaker and hearer; semiotics categorize the *meaning* or names (designatum) of the word signs; and the syntactics are representative of the *basic order* (grammar and structure) of the language. This formulation obviously has heuristic value in a *formed* language as it describes in operational terms the primary properties of linguistic functions. It is equally obvious, however, from the study of the jargon aphasias that the basic matrix for information transfer is the *order processes.* The logical pragmatic class is entirely a function of the ability to communicate in an ordered way: language, either verbal or non-verbal, can have effect only to the extent that it can be fitted with past experience. If the order is so disturbed, as in the jargon aphasias, that no congruency with past experience can be discerned, the only possible effect on the transmitter and receiver is bewilderment and confusion. To only a lesser extent is the semiotic class dependent on the ordered arrangement of the language productions; since meaning, even for specific object designatum, is determined to a high degree by context. If the order, and hence the context is disturbed, the specific meaning of the designata may be distorted; this is particularly important when the multi-ordinality (9) of designata (substantives) is brought into recognition. From the study of jargon aphasia, therefore, a logical three-class formulation of language seems to lack a physiological substrate, and therefore to be of limited value in the elucidation of clinical neurological problems.

Symmetrical lesions such as described in case 1 are relatively rare findings in the

neurological literature. Henschen (8) reported 16 such occurrences and two more were reported prior to the case of Clark and Russell (3). The latter authors described a patient in whom bilateral interruption of the primary central auditory receptive areas resulted in deafness without aphasia. As a result of Clark and Russell's work it is obvious that the destruction of the central auditory connections (and the consequent disuse lesions of the cortex) is insufficient to cause syntactical defects in language. On this basis in our case 1, the cortical lesions in the middle and caudal aspects of the superior temporal region and the supramarginal gyri on the left were sufficient, but probably more than necessary to account for the jargon aphasia. This point however is difficult to evaluate as from perusal of the classical works of Head (7), von Monakow (14, 15), Mingazzini (13), Pick (19), Lowenstein (11), and others, it is noted that neatly circumscribed anatomical lesions isolated to a single Brodmann's area are very rare, and consequently pinpoint anatomical localization represents idealized concepts. The time honored localization of the brain lesion correlated with jargon aphasia however, has been in the middle and caudal parts of the dominant superior temporal gyrus. This relatively focal lesion was certainly demonstrated to be present in our first patient.

CONCLUSIONS

By means of three types of cases, a logical classification of clinical jargon aphasia has been formulated; it is based on the disordered word, sentence and paragraph formations.

Using jargon aphasia material as representative of natural experimental phenomena, it is observed that this clinical condition is representative of but a single element in the class of disordered evocative language function, and consequently, evocative verbal disorders can not be utilized as the sole index of thought processes.

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COMMON SOURCES OF ERROR IN THE DIAGNOSIS AND TREATMENT OF CONVULSIVE DISORDERS: A REVIEW OF 204 PATIENTS WITH TEMPORAL LOBE EPILEPSY[1]

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The interval between the development of new advances in medicine and their application in practice has become relatively short in recent years. No doubt modern methods of medical education, refresher courses, medical meetings and medical journals, not to mention the effect of such "mixed blessings" as the advertising of pharmaceutical firms and articles on medical subjects in lay journals, have greatly contributed to this rapid dissemination of knowledge. This is reflected, for example, in the great advances that have been made over the past twenty years in diagnosis and treatment of convulsive disorders. It is scarcely an exaggeration to state that as a result of modern electrophysiologic, neurochemical, and neurological research, our knowledge of epilepsy has increased in the period mentioned beyond that gained over all previous times put together. Coupled with this there has been a rapid development of pharmacologic research which has resulted in new methods of treatment that have revolutionized the care and outlook for this group of patients. It is indeed gratifying that this scientific progress has been translated so quickly into improved medical care in the daily practice of the vast majority of physicians throughout the country.

One noteworthy exception to this trend would appear to be the diagnosis and treatment of the convulsive disorders associated with pathology of the temporal lobe. Although descriptions of the peculiar clinical spells, usually now referred to as "psychomotor epilepsy," are to be found in the ancient literature, dating back to Hippocrates (14), their correlation with temporal pathology was not established until 1874 by Sanders (21). It remained, however, for Hughlings Jackson (8, 9, 10, 11) to describe more fully this syndrome in the period from 1886 to 1899. In spite of these earlier studies, and in spite of corroborative evidence from time to time, such as the classical human cortical studies of Penfield and his group (18, 19), it was generally accepted until recently in clinical circles that epileptic equivalent states and similar convulsive disorders, now grouped together under the heading of "temporal lobe epilepsy", were uncommon (12). Patients now recognized as having this form of convulsive disorder were previously commonly diagnosed and treated as having grand mal, focal spells, or petit mal, and it would appear that in the main the difficulty mentioned has stemmed from this older and over-simplified clinical concept of diagnostic possibilities.

Temporal lobe epilepsy has been highly publicized over the past seven years since Gibbs, Gibbs and Fuster (7) reported an electroencephalographic focus in the anterior temporal region of one or both sides in many patients who had clinical spells which

[1] The term "temporal lobe epilepsy" is used in conformity with modern neurological usage and includes such older entities as "uncinate fits", "epileptic equivalents", and "psychomotor spells." Strictly speaking, the pathophysiology of the conditions grouped under the generic term "temporal lobe epilepsy" extends in many cases beyond the temporal lobe. The term is justified, however, on the basis of the predominance of temporal involvement in this group of conditions and the fact that it represents a clinical complex of closely related and overlapping convulsive phenomena.

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they termed "psychomotor." In spite of this and the fact that this diagnosis is usually not a difficult one, if a careful history and examination are made in each patient, the condition nevertheless is still being missed in a surprising number of patients. Of equal importance is the fact that the electroencephalogram, when performed in routine manner by certain techniques in common vogue, also frequently misses the correct diagnosis in this same group. The importance of correct diagnosis can be emphasized in its proper perspective only when it is appreciated that the treatment of this condition involves measures which are sufficiently different from the treatment of most other forms of convulsive disorders to result in therapeutic failure in a high percentage of patients if the diagnosis is missed. The importance of the problem can be understood when in conjunction with the above points it is realized that temporal lobe epilepsy has a high relative incidence in adults (2, 14), and its confusion with other forms of epilepsy make it the most common source of error in the diagnosis and treatment of convulsive disorders.

CLINICAL STUDY

The points mentioned have been brought to our attention in a striking manner by a review recently conducted on 204 patients with temporal lobe epilepsy who have been studied at the University of California School of Medicine in San Francisco over the past seven years. Although the patients referred to this clinic in one sense represent a highly selected group, their study nevertheless has revealed important facts that should be of interest to neurologists and physicians in general. The average duration of known spells in the group was nine years, and in this period the great majority of the patients had consulted many physicians, including some specialists, such as neurosurgeons, neuropsychiatrists, and neurologists. Considering this and the fact that approximately 60 per cent of the physicians in California have received their training in other states, the series does possess considerable value in reflecting the level of success achieved by a fairly representative group of physicians in the diagnosis and treatment of this condition over the past seven years. The period of seven years was purposely selected for the study, inasmuch as it has been over this same period that improved diagnostic methods and relatively good treatment has been available for temporal lobe epilepsy.

The series of 204 patients included 108 men and 96 women. Patients were included in the study only when they showed at least two of the three basic criteria that were established for the project, namely, (1) a clear clinical picture of temporal lobe epilepsy, (2) a focus by EEG in the anterior temporal and adjacent regions, and (3) a definite response to therapy for temporal lobe epilepsy when previous anticonvulsive measures had failed to give adequate results. Thus, some patients were included who did not show the EEG focus typical of this condition, but whose clinical picture and response to treatment clearly indicated that they belonged to this group. Again, a few patients were included whose clinical picture was only suggestive, but who showed an EEG focus in one or both of the anterior temporal regions, and who responded to appropriate therapeutic methods. A higher percentage of patients was included (see below) whose response to therapy was questionable or poor and yet whose clinical and EEG findings were clear-cut.

Incorrect clinical diagnoses had been made in 171 patients, or 83.8 per cent. This figure refers only to the diagnoses made by the referring physicians and does not include previous incorrect diagnoses repeatedly made in a high percentage of these patients. No diagnosis had been made in 16 instances. In only 17 patients, or eight per cent, had the correct diagnosis been made by the referring physician. In the great

majority of cases, the patients who were incorrectly diagnosed, and even some of those correctly diagnosed, had been carried along on the usual treatment for grand mal or petit mal. Therapeutic failure was found in 76.5 per cent of the series and in the main the patients were referred on this account, being considered difficult, refractory cases. Since hydantoins, either alone or in combination with one of the barbiturate anticonvulsants, had been used therapeutically in a very high percentage of these patients, the study clearly indicates that these agents will not satisfactorily control a high percentage of these patients. Since certain of the newer anticonvulsive agents, when used in combination with the other measures mentioned, will afford control in over 50 per cent of this group and fairly satisfactory results in as high as 80 per cent, it is obviously of the greatest importance that a correct diagnosis be made.

The most common source of error in the clinical diagnosis in the group reviewed was the neglect of a temporal firing point in the face of associated motor spells of the grand mal, focal, or adversive types. This error occurred in 113 patients, or 55.4 per cent in the series. In these cases the attention of the patient, his family, and the physician as well, were focused upon the more dramatic manifestations of the spell, which result when the physiological discharge from the temporal firing point spreads to frontal and central cortical areas to produce secondary motor attacks of the types mentioned.

The next most common source of error in the clinical diagnosis was the confusion of minor and brief temporal lobe spells with petit mal. This occurred in 56 patients, or 27.5 per cent. This emphasizes the fact that brief psychomotor spells, which only produce a lapse of contact with the environment, superficially resemble petit mal spells. In such minor attacks the discharge does not spread to other cortical areas (although mesial spread to the diencephalon cannot be ruled out in this group), and the spells, therefore, exhibit only manifestations referable to the temporal lobe and possibly the diencephalon.

Other sources of error included the diagnoses of psychiatric conditions, behavior disorders of childhood, migraine, and brain tumors. Considering the known emotional associations of temporal lobe pathology, psychiatric and behavior disorders were quite properly diagnosed in many patients of this group. The mistake came in assuming that the emotional disturbance was all that was present and in missing the associated temporal convulsive problem. The study strongly suggests that the abnormal effect of temporal pathology on cerebral physiology cannot be treated properly by psychotherapeutic methods alone. On the other hand, it was of interest in such patients that an adequate anticonvulsive regimen frequently benefited the associated psychiatric disorders. In the majority of patients of this type, however, both anticonvulsive and psychiatric treatment were required in the overall management of their complex conditions.

When temporal pathology evidenced itself relatively late in life, as frequently was the case, and especially when it evidenced itself in the form of focal neurologic manifestations, such as focal seizures, either alone or associated with focal neurologic signs and symptoms, brain tumors were properly suspected. Too frequently, however, this led to extensive studies that served to rule out a tumor, but did not lead to a proper follow-up in terms of anticonvulsive therapy, adequate to control the underlying condition.

Although neurologic findings were noted in 47 per cent of our patients, unfortunately these did not prove sufficiently characteristic to be of much help in the diagnosis of temporal lobe epilepsy. The findings in the main were limited to weakness of the lower face and upper limb and

hyperactive deep tendon reflexes of the arm on the side contralateral to the pathology.

ELECTROENCEPHALOGRAPHIC STUDY

In addition to the clinical errors referred to, the error in electroencephalographic diagnosis was also a serious one. In 63 patients of this series, previous electroencephalograms had been obtained in other laboratories. This figure is undoubtedly low, inasmuch as information with respect to previous electroencephalographic data was not routinely elicited in all cases. In the 52 patients on whom reports of the previous electroencephalograms were available, a correct electroencephalographic diagnosis had been made in only 10 cases, the temporal focus having been missed in 37 patients, or 71 per cent of this more limited group. In five instances repeat electroencephalographic studies had still failed to show findings typical of temporal lobe epilepsy.

A review of the previous electroencephalographic findings, when compared with repeat electroencephalographic studies obtained in our own laboratory, suggested that the main source of error resulted from the electroencephalographic test having been done in a routine fashion by limited techniques likely to miss all except gross temporal foci.

DISCUSSION

Clinical Considerations

What, then, are the diagnostic points that should help in the differentiation of this group of patients from other forms of convulsive disorders? Since it is an acquired form of epilepsy, the family history should be essentially negative, as is the case in other symptomatic forms of convulsive states associated with pathology. If the condition is of long standing, the birth history or other possible early sources of head trauma should be carefully investigated. A first-born child, in general, is more prone to birth injuries. Studies suggesting uncal herniation at birth (4), as well as the known propensity for head injuries to produce gliosis in the anterior-temporal and low-frontal regions of the brain (3), would appear to explain the high incidence of temporal lobe convulsive disorders.

In addition, neurophysiologic studies indicate that this region of the brain has a very low convulsive threshold (15) which makes it especially susceptible as a "firing point" for convulsive phenomena.

In early life, children with such lesions may present feeding problems, speech and behavior disorders, and enuresis, if not obvious convulsive phenomena. Nocturnal difficulties, missed under the guise of "sleep walking", "nightmares", and enuresis, should be considered in view of the known effect of sleep in exaggerating this type of convulsive disorder. It is well to keep in mind that this type of epilepsy often is not openly manifested until later years and yet in the intervening period may be evidenced by the symptoms indicated. The personality of patients with temporal lobe pathology is often affected, as already mentioned. Hyperactivity, hypersensitivity, introspective trends, increased irritability, and temper tantrums are common characteristics of these patients and no doubt constitute the group previously referred to as having an "epileptic" personality. It is particularly important that this condition be recognized and treated at an early stage, if the psychiatric manifestations, which may be secondary rather than primary, are to be avoided.

At later periods, minor episodes, which usually are atypical and too prolonged for petit mal, may characterize the disease. Episodes of impaired consciousness, including periods of confusion and periods of mental slowing, as well as the more obvious episodes of dreamy states and automatisms, should arouse one's suspi-

cions of temporal lobe epilepsy. Adversive focal seizures are commonly associated with temporal lobe epilepsy and inquiry on this score should always be made. The testimony of a competent observer, among the friends or relatives of the patient, is of the greatest importance, since the patient frequently knows little of the true nature of his spells aside from their aurae. Aphasia as a prodrome of spells originating from the dominant hemisphere is not uncommon. As already mentioned, the effect of drowsiness and sleep in activating temporal lobe spells has been well substantiated and correspondingly the nocturnal incidence of attacks must always be determined. It is important to remember that for every hypoglycemic spell in the early hours of the morning, there will be at least a dozen temporal lobe attacks.

Perhaps the most important diagnostic factor in the spells of late childhood and of adults is the aurae, which so frequently usher in the temporal lobe spells. Since aurae are of value in the recognition of the area of the brain, in or near which the attack has its origin, they possess great diagnostic value and may even suggest the portion of the temporal lobe from which the attack eminates. Penfield (20), on the basis of his extensive experience, has subdivided temporal aurae and symptoms into three main groups. Epileptic discharge from the infero-medial surface of the temporal lobe (comprising the uncus, amygdaloid nucleus, and hippocampal gyrus) produces the episodes of automatic and bizarre behavior for which the patient has no consciousness and which have been termed "automatisms." "Uncinate" aurae, concerned with taste and smell, have been attributed to this same region. The superior and lateral portions of the temporal lobe, on the other hand, are responsible for hallucinations and illusions. Thus, auditory and vertiginous aurae, as well as aurae involving distortions or abnormalities of visual perception may occur. Psychical aurae, such as a sense of familiarity, as though events currently experienced have happened before (*déjà vu*), a feeling of unreality within, or again a feeling that everything without seems strange (*déjà jamais*) are fairly common in such patients. Fear as an aurae, however, has been attributed to the temporal lobe (16, 17, 22). The third main category of Penfield's is concerned with gastro-intestinal symptomatology (and possibly respiratory, as well) and has been related to the insular region. Belonging to this category, epigastric aurae and other gastro-intestinal symptoms associated with spells, as well as chewing movements of the mouth, are the most common. Perhaps because of the popular misconception that aurae are something apart from the attacks, patients frequently do not volunteer information on their aurae, and this is especially true if the aurae are of a psychical type which the patient may be hesitant to mention, because he is fearful of their imagined psychiatric significance.

Electroencephalographic Considerations.

The main point in connection with electroencephalographic diagnosis concerns the fact that in many electroencephalographic techniques only one or two electrodes are placed over or near each temporal lobe. It is not surprising that such limited techniques often fail to reveal temporal foci of which the electroencephalographer can be sure. Having convinced ourselves by controlled studies of this potential pitfall in electroencephalographic diagnosis a number of years ago, our technique was altered in an effort to overcome this difficulty. A minimum of 18 electrodes is used on all adult patients and eight of these are either over or immediately adjacent to the two temporal lobes in the low frontal and central areas. Recording by both scalp-to-scalp and scalp-to-ear methods is obtained in all cases. All different combinations of homologous runs,

with at least 45 homologous settings for each patient, are obtained simultaneously and side by side in order to facilitate a direct comparison in all respects. Activating techniques are used liberally and both hyperventilation and sleep are used routinely when a temporal lobe disorder is suspected. With this technique, anterior temporal foci, consistent with the diagnosis of "psychomotor epilepsy" have been demonstrated in 190 of our series, or 93 per cent.

The need of thorough clinical study prior to obtaining an electroencephalogram also should be stressed. Unless temporal lobe epilepsy is suspected and the electroencephalogram is modified and adapted to the problem at hand in each case, it is bound to miss a fair percentage of this group of patients. In many the temporal focus is not manifested by spiking or even gross delta activity. Little may be apparent except when the patient is drowsing off or sleeping lightly. Again, the value of intravenous injections of metrazol in activating temporal foci has been stressed (6, 13, 26).

In addition to this, it should be mentioned that modern electroencephalography is not only a diagnostic tool but is a technique which enables the clinician to study underlying physiologic factors in each individual patient which may be of importance because of their influence on the underlying convulsive condition (1). Such factors should be assessed in each case, since their convulsive significance varies greatly in different patients and in different types of convulsive disorders. In temporal lobe epilepsy, for example, the activation produced by drowsiness, sleep, hydration, alcohol, and alkalosis may be of importance. Electroencephalography affords an excellent method of studying such mechanisms in the individual patient. Because such factors may be of great importance in the practical therapeutic management of this difficult group of patients, the necessity of closely integrating electroencephalography with the clinical study and therapeutic management of each individual cannot be overstressed.

In summary, the famous aphorism attributed to Jenner might be quoted: "More mistakes are made by not looking than by not knowing." As indicated, we have made great strides in our knowledge of temporal lobe epilepsy, but in medicine, as in everything else, one is likely to find only that for which one is looking. If one does not think of the possibility of temporal lobe epilepsy, one is not too likely to find it and the testimony of medical practice from the time of Hughlings Jackson up to the present strongly bears this out.

CONCLUSIONS

A review of 204 patients with temporal lobe epilepsy revealed that the correct diagnosis had been missed in over 80 per cent of this selected group. In over 50 per cent the diagnosis of grand mal, or some other type of motor seizure, had been made due to the fact that the temporal firing point was lost sight of in the face of the more dramatic, secondary motor manifestations of the spells in this group. In over 25 per cent minor spells, which did not spread to other portions of the brain, were misdiagnosed as petit mal. Other sources of error included psychiatric diagnoses, migraine, and brain tumors.

Therapeutic failure was found in approximately 75 per cent of the patients. It appeared that this was due in the main to the primary error of diagnosis, although in some cases, even when a correct diagnosis had been made, inappropriate anticonvulsive measures had been used.

In 52 patients, who had previous electroencephalographic studies and on whom the electroencephalographic reports were available, the correct diagnosis had been missed in 70 per cent.

The causes of diagnostic failure, both

clinical and electroencephalographic, have been analyzed and the importance of the problem stressed, in view of the fact that this condition constitutes the most common source of error in the diagnosis and treatment of convulsive disorders.

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EFFECT OF METHEDRINE ON CRITICAL FLICKER FUSION AND ITS RELATION TO PERSONALITY AND AFFECT

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The concept that differential tolerance to sedatives may reflect significant aspects of affect and personality led to development and validation of the sedation (13) and "sleep" (16) thresholds. These measures of tolerance to amobarbital have been found related to several variables which are of psychiatric interest, and the tests have been applied in psychiatric diagnosis (14, 15). The positive results with tests of sedative tolerance encouraged us to seek a method for measuring tolerance to excitants, as a reliable and valid test of excitant tolerance should also contribute valuable information about central nervous function in personality disorders. The present report deals with the results obtained in an exploratory attempt to devise a method for measuring excitant tolerance, and to relate the findings with this test to aspects of personality and affect.

The excitant drug chosen for this work was *d*-*N*-methylamphetamine hydrochloride (methedrine, desoxyn, pervitin). This agent has been used in psychiatry for over two decades, both as a symptomatic treatment for mild depressions and to facilitate psychotherapeutic exploration (7, 12). It is a sympathomimetic amine, closely related chemically to amphetamine and ephedrine, which can stimulate effector organs innervated by adrenergic nerves. Its outstanding characteristic, however, is said to be a strong stimulant action on the central nervous system (4).

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The threshold for critical flicker fusion (CFF) was selected as a measurable index of the effects of a standard intravenous dose of methedrine. CFF has been defined by Simonson and Brozek (17) as "that rate of successive light flashes from a stationary light source at which the sensation of flicker disappears and the light becomes 'steady'." There have been a very large number of investigations employing CFF. Landis has compiled a bibliography of 1300 titles (9), and has reviewed the numerous factors which influence the phenomenon (10). In general, excitant drugs appear to increase CFF, while depressants lower it. Simonson and Enzer (18) found that methedrine, in oral doses of 5 to 7.5 mgm., increased CFF. This finding would indicate that the central excitatory action of methedrine out-weighs its vasoconstrictor effect on retinal vessels, as it has been shown that epinephrine reduces CFF and that this effect of epinephrine is reversed by nitroglycerin, a vasodilator (6). It thus seemed reasonable to proceed with this study on the working assumption that the amount of change in CFF produced by methedrine would provide a measure of some aspect of central nervous excitability.

To assess the psychiatric relevance of the effects of methedrine on CFF, these were compared with a variety of clinical appraisals and tests in a group of psychiatric patients. The tests included the sedation threshold and questionnaire measures of introversion-extraversion and anxiety. The affective reactions to methedrine were also studied in relation to the CFF changes. Part of this study consisted of an experiment carried out to assess the effects of methedrine on CFF by comparing the responses to methedrine, water, and no in-

jection. These methodological data will be presented here, together with results bearing on the test-retest reliability of CFF.

METHODS

CFF Apparatus. The light source was a Grass P. S. 1 photic stimulator which produces intermittent flashes of 10 microseconds constant duration. The lamp face was covered with black paper, except for a central circular aperture, 0.5 in. in diameter. This aperture was screened by neutral density and ground glass filters to reduce the intensity. The lamp was mounted 4.5 in. behind a black-painted screen, 28 by 16 in.; a cylinder 2 in. in diameter was placed between the lamp and the screen to prevent escape of light. The illuminated test patch was a circle of opal glass, of 1.77 sq. in. area. The luminance at the patch during the peak of the flash was 45 millilamberts. Tests were conducted in a light-shielded room, the only extra source of illumination being a 15 watt shaded fluorescent desk lamp situated 5 ft. posterolaterally to the subject. The subject was seated so that the nasion was 12 in. from the test patch, with head held in position by an optical chin rest. Binocular vision was employed.

Methedrine-CFF Test Procedure. The subject was first allowed to dark adapt for 3 min. Because there was a certain amount of extraneous pulsation, which could not be entirely eliminated, gross differences in flicker were then demonstrated to the subject by showing him "flickering" light at 25 f.p.s. and "steady" light at 60 to 70 f.p.s. Care was taken to be sure that the subject grasped the point that true flicker was regular and involved the whole patch, whereas extraneous pulsations were not regular and did not involve the whole patch. The subject was instructed to say "Yes" or "No" when the light was turned on, the affirmative indicating that he saw flicker. After the instructions, 8 readings, alternating from flicker to steady (ascending) and fusion to flicker (descending), were taken. Each exposure lasted about 3 sec. This constituted the pre-methedrine determination of CFF. The room lights were then switched on and an intravenous injection of 0.15 mgm./Kg. methedrine was given over about one minute. The room light was then turned off and CFF was tested, exactly as before the injection, 10, 20, 25, and 30 minutes after the injection. There were thus eight pre- and 32 post-drug readings. The mean of each block of eight readings was taken as the value for that time interval. During the 30 min. period after injection, the experimenter also inquired about the subject's affective reactions. These were often quite pronounced and on several occasions post-injection testing could not be carried out.

Subjects. Subjects were 75 psychiatric patients, 18 men and 57 women, ranging in age from 15 to 60 years (Mean: 37.4). They were consecutively available admissions to the psychiatric wing of a general hospital, selected mainly on the basis of capacity to cooperate for testing. Patients with recent ECT or whose abreaction after methedrine precluded post-drug testing were excluded. Although we attempted to discontinue all medication for 12 hours before the test, 21 patients received some medication. The patients were classified diagnostically by the investigators without any reference to the CFF data. The diagnostic scheme previously used in sedation threshold studies was employed (14). There were 26 cases with diagnosis of psychosis including: depression, twelve; schizophrenia, eight; "borderline" schizophrenia, four; paranoid state, two. Neurotic patients totalled 33 and included: depression, eleven; anxiety state, five; anxiety hysteria, two; mixed neurosis, five; obsessive-compulsive, three. Nine chronic alcoholics were placed in a separate group. Of the remaining seven cases, three were undiagnosed, and there was one each of: mental defect due to birth injury, Wilson's disease, temporal lobe epi-

lepsy, and organic brain syndrome. It should be mentioned that the number of cases excluded because of abreaction was less than 10 per cent of the total; in preliminary tests, methedrine was given in higher doses than 0.15 mgm./Kg. and this led to more frequent severe abreactions.

In addition to the main subject group, ten nonpatients (three male physicians and seven female nurses) and six additional patients were used in control studies of the effects of methedrine.

Control Studies. To compare the effects of methedrine and water, 20 patients were tested twice. Half received 10 cc. sterile water in the first test and methedrine in the second test; in the other half the order of injection was reversed. To determine the effects of an injection per se on CFF, four of these patients received a test in which no injection was given. Six additional patients received tests with water injection and no injection, and five nonpatient subjects received similar tests, the order of testing being arranged so that about half the group was tested first with one procedure. Five nonpatients were tested on one occasion with methedrine and on another with no injection.

Questionnaire Tests. The Guilford R and S scales were used to measure introversion-extraversion; questions were typed on cards which were sorted into YES, NO, and ? compartments in a box (5, 15). The Cattell I.P.A.T. Anxiety Scale (1) was given in the form of a typed questionnaire. Both scales were self-administered in the absence of the examiner. The scores were converted to standard values according to instructions in the manuals. The questionnaire data were used only in the patients diagnosed as psychoneurotic.

Sedation Threshold. The procedure using an injection rate of 0.5 mgm./Kg./40 sec. was followed, with results based on measurements of tracings from the output of an electronic integrator tuned to summate 17 to 25 c/sec. frontal activity (13).

Appraisals of Affect and Personality. Affect was assessed before the test by the experimenter. Categories used were: anxiety, depression, anxiety-depression, elation, and absence of dysphoria. The affective reaction to injection was classified in terms of shift along a dysphoria-euphoria continuum, as "better", unchanged, or "worse". As fluctuations seemed to occur, provision was made for classifying each half of the observation period separately. Personality in nonpsychotic patients was rated from case records as: hysterical, mixed or obsessional, using the criteria described by Shagass and Kerenyi (15).

For a variety of technical and administrative reasons, some appraisal and testing procedures other than the methedrine-CFF test could not be completed in a few subjects. The 5 per cent level of confidence was adopted as the minimal criterion of statistical significance.

RESULTS

Repeatability of CFF. Two initial CFF values, determined on separate days, were available for each of 36 subjects used in control studies. The product-moment correlation coefficient, indicating the concordance between test and retest, was 0.40, significant at the 2 per cent level of confidence. This finding indicates that the day-to-day repeatability of the CFF determination was not great. However, it was possible to show that the CFF measure was quite stable during the 30 min. test period. This was demonstrated by using the data from the 20 subjects tested with no injection. Rank order correlation coefficients were calculated between the values corresponding to 10 min. intervals, *i.e.*, pre, 10, 20, and 30 min. Of 6 coefficients, 5 ranged from 0.92 to 0.99. The other coefficient was 0.84; it was obtained between CFF values at 0 and 30 min., *i.e.*, those with the greatest time separation.

Effect of Methedrine on CFF. Mean CFF values for subjects tested under different

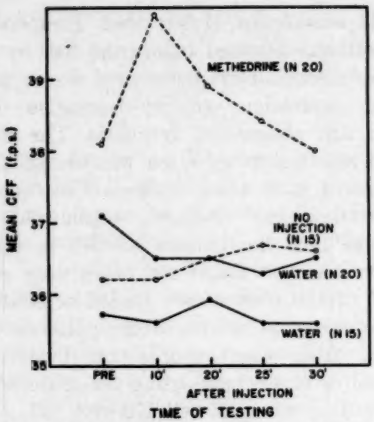

FIG. 1. Mean CFF values before and after injections on different days of methedrine and water, compared with values obtained with no injection. The (N = 20) water group also received methedrine and the (N = 15) water group also received no injection.

conditions are shown in Figure 1. The two groups injected with water are shown separately, as their alternate tests were different. The only statistically significant change in CFF was with methedrine, the greatest mean increase occurring 10 min. after the injection. These data prove that it was methedrine alone, and not the reaction to receiving an injection, which produced the average increase in CFF.

In the analysis of methedrine-CFF data, four scores were used. These were: initial value (pre), change at 10 min., maximum change, and mean change after injection. The maximum was based on the mean values for blocks of 8 readings. For the group of 75 patients, the three change scores were negative, *i.e.*, CFF decreased after methedrine, in 25.3, 24.0, and 28.0 per cent of cases. This represents a trend in the direction of increase which, when compared with 50 per cent chance expectancy, was significant at the 1 per cent level of confidence. There was no significant correlation between the initial CFF values and the amount of change following methedrine injection, so that the change scores could be used without taking the initial values into account.

Effect of Age, Sex, Smoking, Time of Day, Drug Intake and Amount of Methedrine on CFF Scores. Statistical analysis revealed only one possibly significant relationship between any of these factors and the four CFF scores. Patients who had smoked one or more cigarettes or pipes on the same day prior to testing showed a lower mean CFF change after methedrine than those who had not smoked. The means were 0.35 and 1.47 f.p.s. respectively, and the difference achieved the 5 per cent confidence level. However, the other three CFF scores did not differ significantly in "smokers" and "non-smokers". The total amount of methedrine administered ranged from 5 to 14 mgm, with a mean of 9.2 mgm, and the CFF changes were not related to this amount, supporting the validity of taking body weight into account in the dosage.

Affective Changes Produced by Methedrine. Taking the pre-injection state as a baseline, affective changes during the 30 min. period following methedrine injection were assessed as follows: "worse", 19.2 per cent; unchanged, 15.1 per cent; "better", 49.3 per cent; diphasic change, 16.4 per cent. Comparing the affective changes with the pre-injection state, it was found that only those 14 subjects considered to be non-dysphoric or elated showed a predictable shift in affect. Only one of these felt "worse" for a very brief period and then returned to the pre-injection feeling state before the test ended. This was in contrast with over 25 per cent "worse" reaction in the dysphoric patients. There was no difference in distribution of affective reactions in patients with preinjection anxiety, anxiety-depression, or depression. The type of affective reaction to methedrine was also not significantly correlated with the CFF scores. Nor were any significant relationships found between the affective reaction, and psychiatric diagnosis, clinical personality appraisal, Guilford introversion-

TABLE 1

Means and Standard Errors of CFF Scores for Diagnostic Groups (in f.p.s.)

Diagnosis	No. Cases	CFF Pre		10′ Change		Max. Change		Mean Change	
		M	S.E.	M	S.E.	M	S.E.	M	S.E.
Psychotic Depression	12	37.4	0.48	2.0	0.39	3.0	0.53	1.8	0.49
Neurotic Depression, Anxiety State	16	35.9	0.97	−0.5	0.77	−0.2	1.06	−0.1	0.69
Mixed Neurosis, Anxiety Hysteria	7	36.3	1.59	2.0	0.83	1.5	1.24	0.8	0.72
Hysteria	7	41.5	3.72	3.8	1.89	4.5	1.70	2.5	1.81
Alcoholism	9	37.0	1.72	1.3	0.98	2.9	1.60	1.7	1.04
Schizophrenia	8	36.3	1.14	0.5	1.76	1.3	2.71	−0.7	1.61
Other	16	36.2	1.03	0.3	0.80	0.9	1.11	1.0	0.81

extraversion scores, or I.P.A.T. anxiety scores.

Relationships between CFF Scores and Psychiatric Diagnosis. The only comparison possible between patients and the ten nonpatients was for the initial CFF value; this did not differ significantly in the two groups. As the number of cases in the patient groups was small, certain groups were combined for statistical purposes wherever it seemed reasonable to do so. Table 1 shows the means and standard errors of the four CFF scores for each group. Calculation of the critical ratios for differences between means revealed several significant differences, all in the change scores; the initial CFF values did not differ significantly. The neurotic depression-anxiety state group showed significantly *less* change with methedrine than the psychotic depression group, the confidence levels being 1, 2, and 5 per cent for the 10 min., maximum, and mean changes respectively. The neurotic depression-anxiety state group also had a smaller mean change at 10 min. than either the mixed neurosis-anxiety hysteria or the hysteria groups ($P < .05$ in both instances). The maximum change was also significantly less in the neurotic depression-anxiety state than in the hysteria group. Figure 2 shows the proportion of CFF changes at 10 min. above and below 1 f.p.s. for the four groups with significant differences. The graph demonstrates a gradient from the neurotic depression-anxiety state group through the mixed neurosis to the hysteria group. As smoking appeared to affect the mean CFF change results, diagnostic relationships with CFF scores for "smokers" and "non-smokers" were determined separately; they showed the same trends.

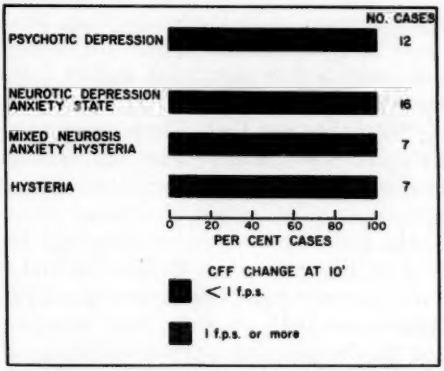

FIG. 2. Comparison of CFF change at 10 minutes in four patient groups. Note the greater proportion of small CFF responses in the neurotic depression-anxiety state group, and the gradient from this group to hysteria.

It may be noted that, of 19 patients showing decreased CFF after methedrine, eight or 42.1 per cent were in the neurotic depression-anxiety state group, whereas this group constituted only 21.3 per cent of the total sample. The only other group with a high incidence of negative CFF responses was the schizophrenic, four of eight patients showing a decrease. The difference in incidence of negative responses between these two groups combined and the remain-

TABLE 2

Some Relationships Between CFF and Guilford R and S Standard Scores

CFF Change at 10′ min.	R Score	
	<6	6+
<1	5	11
1 or more	9	4
CFF Max. Change	**S Score**	
	<6	6+
<1	7	4
1 or more	5	13

ing patients was significant at the 1 per cent level.

Personality and CFF. There was no statistically significant relationship between any of the CFF scores and the clinical appraisals of hysterical-obsessional trend. Table 2 shows the two relationships between CFF scores and Guilford R and S scale scores which approached statistical significance. Both are in the same direction, and they suggest that a greater CFF change accompanies introversion than extraversion. The trend for the R score was significant at the 5 per cent level, while that for the S score did not quite achieve this level of confidence ($P = .06$).

It may be noted that these trends were opposite to those found for psychiatric diagnosis, as hysterics, who had the greatest CFF changes, would be expected to be more extraverted. This discrepancy led us to determine the relationships between the Guilford scores, clinical personality appraisals, and the sedation threshold. The Guilford R scores were significantly correlated with hysterical-obsessional trend ($P = .02$), while the S scores showed the same, but not statistically reliable, trend for greater introversion in obsessionals. The sedation threshold was correlated with personality appraisal in the direction of higher thresholds in obsessionals ($P < .001$), but was not significantly correlated with the Guilford scores. The absence of correlation between the threshold and Guilford scores was contradictory to previous findings (15), even though the present number of cases, 24, was smaller. Seeking a possible reason for this, it was noted that the major procedural difference between the present and previous study was that the questionnaires were self-administered by the patient on the ward, whereas previously they were done in the presence of the examiner. Examination of the nurses' ward notes revealed that, at least in some cases, the attitude taken toward the Guilford test was overtly non-cooperative, the patient stating that the cards were sorted without attention to content. This fact throws present Guilford scale findings open to serious question.

CFF and Sedation Threshold. No significant relationships were found between any CFF score and the sedation threshold in 58 patients with both tests. This was perhaps surprising, as the relationships between CFF changes and diagnosis were similar to those obtained with the sedation threshold, and the relationships between the threshold and diagnosis in the present group of subjects was as expected from previous results (14).

CFF and I.P.A.T. Scores. There was no significant relationship between any CFF score and the I.P.A.T. total score. It may be noted that the latter was generally very high, as 72.8 per cent of subjects had a sten (standard score) from 8 to 10, which represents high anxiety.

CFF and Affect Before Methedrine. There was also no relationship between the CFF scores and the pre-methedrine affective state.

DISCUSSION

Present data confirmed the finding of Simonson and Enzer (18) that methedrine increases CFF. These writers attributed a mean increase of 5.5 f.p.s. to the drug, but this value was calculated from the difference between the average decrease in a

working day and the average increase when methedrine was given. From Table 1 in their paper it is possible to calculate the mean maximum increase in 27 experiments on 11 subjects; this value was 1.66 f.p.s., which is almost the same as the comparable value of 1.59 f.p.s. obtained in the present study. It may be noted, however, that Simonson and Enzer found the time of maximum increase to be from 90 to 240 minutes after oral administration, whereas such increases usually occurred from 10 to 20 minutes after intravenous injection in the present study. Although these time differences may be due entirely to differences in rate of absorption, the fact that average CFF values returned to pre-injection level after 30 minutes in the present study seems to require further explanation. One possibility is that the effect of methedrine on CFF may be multiphasic and that further changes may have occurred after the observation period was discontinued. The work of Liddell and Weil-Malherbe, who measured plasma adrenaline concentrations following injection of large doses (40 to 60 mgm.) of methedrine, showed that this drug produces a multiphasic change in adrenaline concentration, and that there may be considerable individual variation in the succession of increases or decreases in concentration (11). A repetition of Liddell and Weil-Malherbe's experiment with concomitant CFF determinations might clarify several aspects of this problem.

The present results on the repeatability of CFF indicated that the determination was sufficiently stable over a 30 minute period to permit reliable assessment of the effects of a drug. However, the day-to-day reliability seems too low to foster any expectations that CFF may reflect stable personal characteristics. Such expectations may be implicit in attempts to relate CFF to personality trends (17). While the low reliability of the CFF measure does not necessarily vitiate statistical results obtained in studies of this sort, the clinical application of such findings to individual cases would seem questionable. This view is similar to that of Landis (10), who has discussed the problems of CFF variability in some detail.

The affective reactions to methedrine were of considerable interest, even though they were not found to be related to any CFF changes or to most clinical appraisals of personality or preceding affect. The majority of our subjects felt "better" after methedrine. The change of affect was often dramatic and immediate, *i.e.* many subjects spontaneously, and in glowing terms, described a feeling of well-being in terms like; "I feel wonderful!", "This is a miracle! I feel like a new man!". Such reports were given by several patients who felt tense and apprehensive before injection. On the other hand, some patients complained of an increased feeling of tenseness, of feeling "funny", or they just cried uncontrollably. This diversity of affective reactions was in agreement with the findings of Jonas (7), who stated also that patients with symptoms of anxiety "fared well as a group", experiencing "euphoria" and freedom from symptoms. In our group, 17 of 33 patients, with a history of symptoms characteristic of anxiety, felt "better" after methedrine. These findings seem contradictory to the often heard opinion that amphetamine and methedrine enhance anxiety symptoms. Present results, and those of Jonas, suggest that the affective reaction to methedrine cuts across accepted diagnostic and descriptive categories, and that these categories do not provide any sound basis for predicting clinical responses to the drug. Nor do the effects of methedrine on CFF seem to offer any solution to this problem.

The relationships found between CFF changes with methedrine and psychiatric diagnosis present a striking parallel with previously described diagnostic relationships of the sedation threshold (14). Before discussing these further, it may be well

to emphasize that the present data were based on few cases, and that the results require confirmation. Also, the diagnostic results did not agree with the Guilford personality data; however, for reasons mentioned earlier, the Guilford data may be questioned. The present diagnostic difference in which most confidence can be placed is that between patients with psychotic depressions and neurotic depressions or anxiety states. The patients with psychotic depressions, who had low sedation thresholds, had a greater CFF response to methedrine than those with neurotic depressions, who had high sedation thresholds. Although at first glance this result may seem to be in the direction expected from contrasting actions of an excitant and a depressant, the opposite is the case. This is because the sedation threshold measures the *variable amount* of amobarbital required to reach a given level of central nervous system depression, so that a high threshold means low sensitivity; on the other hand, the CFF response to a *standard dose* of methedrine should be greater when there is low sensitivity to the drug. Consequently, the finding is that the same patient groups had low or high sensitivity to both methedrine and amobarbital. Parenthetically, it may be noted that such a trend was present in the direct correlations between the CFF scores and sedation thresholds, although not statistically significant. This paradoxical trend suggests that great caution should be exercised in predicting properties of a drug from its classification as an excitant or depressant. Another speculation suggested by this finding is that there may be some cerebral factor of drug tolerance, which is not specific for any particular type of drug, so that the same individuals would be more tolerant to both excitants and depressants. Present data suggest that such a tolerance factor, if it exists, may be significantly related to psychiatric diagnosis.

One may attempt to fit present results for the neuroses with two lines of investigation. The first is the association between "anxiety" and lowered CFF reported by Krugman (8) and Goldstone (3). We obtained evidence to suggest that methedrine lowers CFF in patients diagnosed neurotic depression and anxiety state more often than in other groups. If methedrine could be regarded as facilitating an "anxiety" effect on CFF, this finding would agree with those of Krugman and Goldstone. However, as noted previously, the clinically observed reactions to methedrine did not support the assumption that methedrine facilitates "anxiety". The other line of investigation deals with the introversion-extraversion dimension of personality. Simonson and Brozek (17) state that Washburn, in 1930, found lower CFF in extraverts than in introverts, and that Madlung of Germany found similar results; they themselves reported lower CFF means in extraverts. They anticipated that "the extraverts would have higher excitability, reflected in higher CFF values", and found the reverse relationship difficult to explain. Eysenck (2) has interpreted the previously cited findings of Krugman and Goldstone as suggesting that introverts (who would be dysthymic and anxiety-prone) have lower CFF than extraverts. He has attempted to relate these findings to a prediction, based on his inhibition theory of hysteria, that extraverts and hysterics, by virtue of greater inhibitory potential, would have lower thresholds of temporal discrimination and, consequently, higher CFF. This prediction is obviously at odds with the findings of Simonson and Brozek (17). If one attempts to extend Eysenck's prediction to cover the effects of methedrine on CFF, and assumes that methedrine decreases inhibition, then the general increase in CFF produced by methedrine is itself contrary to expectation. Also the differences found here between dysthymics and hysterics would require very complicated, and unsupported, assumptions if one attempted to relate them to Eysenck's view. It would

seem that a better understanding of the mechanisms of CFF must be gained before theoretical speculation along these lines can become profitable.

Finally, it should again be emphasized that the present study was of exploratory nature in its attempt to determine psychiatric correlates of the methedrine-CFF determination. The positive results, although few, suggest that further investigations with this or similar methods may be worthwhile. Certainly the concept of excitant tolerance seems promising, although other indicators may prove to be more suitable than CFF.

SUMMARY

This study was carried out to devise a method for measuring tolerance to a central excitant drug, methedrine, and to explore the psychiatric relevance of this measure. The test consisted of determining the effect of 0.15 mgm./Kg. of intravenous methedrine on critical flicker fusion threshold (CFF). In initial studies, methedrine was shown to increase CFF, in contrast to water injection or no injection; the increase occurred in about 75 per cent of subjects. The repeatability of CFF over the 30 min. test period was also shown to be adequate, although the day-to-day repeatability was low. The methedrine-CFF test results of 75 psychiatric patients were then compared with: psychiatric diagnosis, preinjection affect, affective change following methedrine, clinical appraisal of hysterical-obsessional trend, Guilford R and S scores of introversion-extraversion, I.P.A.T. anxiety score, and sedation threshold. The effects of age, sex, smoking, previous drugs, and time of day on the methedrine-CFF results were also assessed.

The following statistically significant relationships were found between the variables studied. (a) Patients who smoked before the test showed less increase of CFF after methedrine. (b) The incidence of increased dysphoria after methedrine was less in previously elated and non-dysphoric than in dysphoric patients. There was no difference between patients with anxiety and depression in affective reaction to methedrine. (c) Patients with neurotic depressions or anxiety states showed more frequent decreases and less mean increase in CFF than patients with psychotic depressions, mixed neuroses, or hysteria. (d) There was a questionable trend for patients with high Guilford introversion scores to show greater CFF increases after methedrine.

It was considered that the relationships between psychiatric diagnosis and the CFF change with methedrine, which parallel sedation threshold findings, encouraged further work along the lines of the present study, although a less difficult indicator than CFF would be desirable.

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TWO FACTORS LIMITING THE RELIABILITY OF THE MECHOLYL TEST: VARIABILITY IN DAY-TO-DAY RESPONSES AND DISSIMILARITY BETWEEN SIMULTANEOUS BILATERAL DETERMINATIONS

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Mecholyl (acetyl-beta-methyl-choline) is a parasympathomimetic agent which, on administration, produces the muscarinic action of acetyl choline. Its many noticeable effects include cardiovascular actions, such as peripheral vasodilatation, with changes in heart rate, drop in blood pressure, flushing of the skin, and sensations of warmth; gastrointestinal actions, such as increase in the tone and amplitude of the contractions of the gut; respiratory actions, such as bronchial constriction; glandular actions, such as lacrimation, salivation, sweating; and others (18).

The effects of mecholyl on the cardiovascular system, and specifically on changes in the systolic blood pressure, have been singled out for application as a clinical test in psychiatry. The fluctuations in the systolic blood pressure which follow the injection of mecholyl have been grouped into certain distinct response patterns (16): a hyporeactive response (group V) where elevation of the blood pressure to the pre-injection resting level is not established within twenty-five minutes (Figure 1); a normoreactive response (group II–III) where homeostasis is established within twenty-five minutes (Figure 2); and a hyperreactive response in which the systolic blood pressure rebounds above the resting level. This last response can be further subdivided into two groups: in one (group I) the systolic blood pressure remains elevated for at least twenty-five minutes (Figure 4), while in the other (group IV) the blood pressure returns to the pre-injection resting level within this period (Figure 3).

As will be described later, these patterns have been variously correlated with a number of physiological and psychological variables. There is, however, no unanimity concerning most proposed correlations and, in some instances, frankly contradictory observations have been published (25, 27, 37). Since no information was available at the time this study was initiated as to the constancy and reproducibility of mecholyl responses under controlled experimental conditions, a study was designed to answer the following questions:

1. Is the response to mecholyl in the same subject identical from day to day when measured by the same observer under constant basal conditions, and under circumstances when the state of the patient is not being deliberately influenced by specific or non-specific therapeutic activities?

2. Are the mecholyl response patterns obtained simultaneously from both arms by two observers identical?

3. Does the site of the injection influence the response patterns obtained simultaneously in the two arms?

MATERIALS AND METHODS

This study was undertaken on a sample of 33 subjects (26 females and seven males), all inpatients at an acute psychiatric treatment and research center (LaRue D. Carter

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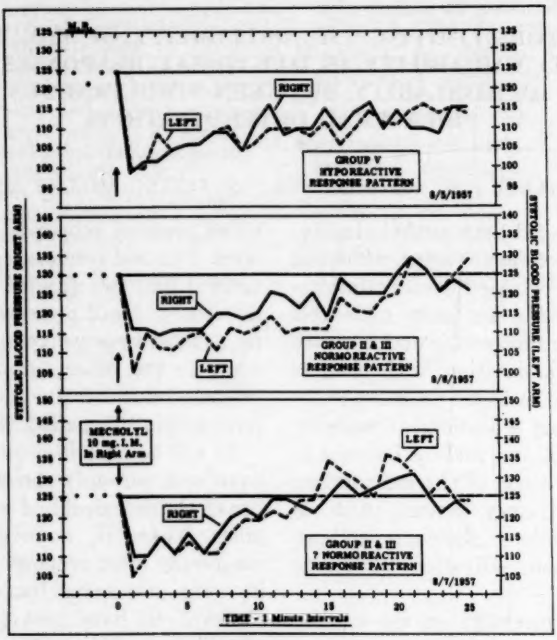

FIG. 1. Progressive increase in reactivity of systolic blood pressure responses to mecholyl from a hyporeactive response pattern to a normoreactive response pattern.

Memorial Hospital, Indianapolis). Thirty of these patients were diagnosed by their physicians as suffering from schizophrenic reactions. In the remaining three the clinical diagnosis was manic-depressive psychosis, character disorder, and unstable personality, respectively. The patients ranged in age from 13 to 40 years; a distribution is shown in Table 1.

Excluded from this study were all patients over the age of 40, patients with organic brain disease, endocrine disorders, asthma, peptic ulcer, hypertension (upper limit of normal B.P. 140/90), and heart disease.

TABLE 1

Age Distribution of Patients

Age Range	13-19	20-24	25-29	30-34	35-40
Number	4	12	5	7	5

Each patient was subjected to at least one mecholyl test series. A series consisted of four separate mecholyl injections, administered into the right deltoid on four days out of seven and under the same experimental conditions. All the tests were undertaken in the morning between two to three hours after breakfast and following 45 minutes of bedrest. No patient was moved from his bed or into another ward during the test period. The interval between admission and administration of the mecholyl test series in the twenty-seven patients who were tested before treatment varied from one to four weeks. The distribution within this period of the completed test series is shown in Table 2. The test was started only after stable resting systolic blood pressure readings had been obtained. The mecholyl solution was made up freshly from the powdered form for each injection. One ml, containing 10 mg of mecholyl, was

injected intramuscularly into the right deltoid.

No somatic therapy, as for example ECT, insulin, tranquilizing agents, or barbiturates, was administered during the testing period. The only drug permitted was chloral hydrate, 1 gm at night where necessary for sleep.

Following the injection of mecholyl, systolic blood pressure estimations were recorded every minute for 25 minutes. The same observer recorded all four test readings in each series with the same instrument (a mercury type sphygmomanometer), and, in unilateral estimations, always from the right arm. Of the 54 complete series, 42 were read from the right arm and 12 were read from both the right and left arms simultaneously by two observers. The results were charted on graph paper showing the systolic blood pressure as the ordinate and the time as the abscissa. The areas below and above the baseline were measured with a planimeter, and the response groups categorized on the basis of the above mentioned response patterns.

Series of four mecholyl tests were given to 18 patients before, to six patients after, and to nine patients both before and after a course of somatic therapy. (By the term somatic therapy is meant insulin coma or electric shock treatments, or both.)

FINDINGS AND COMMENTS

Consistency of response patterns in each series of four consecutive mecholyl tests. Table 3 shows the variabilty of response patterns within each series of four tests. Of the 42 right-sided series, which includes nine patients who were tested both before and after treatment, only seven series presented consistently identical response patterns throughout the four consecutive tests. In 29 series, two different response patterns and in six series three different response patterns were obtained. A statistical evaluation of these findings in the pre-treatment group shows that at a 95 per cent confidence interval identical mecholyl response patterns on two consecutive days can be expected to occur in the same patient only between 44 to 60 times out of a hundred. It may be contended that this variability reflects the instability of newly admitted patients within the first week of their admission to the hospital. A review of the data for the different groups which were tested after varying time intervals following admission to the hospital (Table 2), reveals no significant differences. Nor was the variability significantly different in the post-treatment group of patients.

Figure 1 demonstrates a gradual increase in reactivity of the systolic blood pressure response in the same patient over a period of three days. While on the first test (8–5–57) his response was hyporeactive (group V), the following day he reached the basal resting level after 16 minutes, and the day after that after 11 minutes. That this change in the response is not related

TABLE 2

Interval In Days Between Admission to Hospital and Administration of Mecholyl Test Series in the Pre-treatment Group of Patients

Days	2–11	5–16	10–21	20–30
Number of Patients	9	9	6	3

TABLE 3

The Number of Different Response Patterns Encountered within each Series of Four Mecholyl Tests

No. of Different Response Patterns Occurring in a Series of Four Tests	Frequency Distribution				Total			
	Before Treatment		After Treatment		Number		%	
	Right	Left	Right	Left	R	L	R	L
One	6	1	1	0	7	1	18.6	8.3
Two	16	6	13	4	29	10	69.0	83.3
Three	5	1	1	0	6	1	14.3	8.3
Four	0	0	0	0	0	0	—	—
Total	27	8	15	4	42	12		

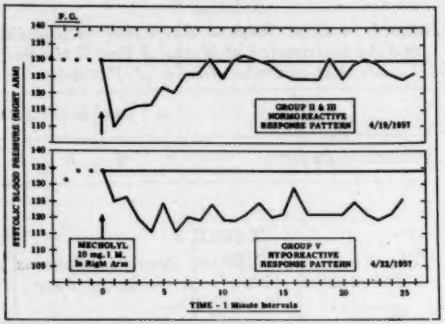

FIG. 2. A decrease in systolic blood pressure responses to mecholyl from a normoreactive response pattern to a hyporeactive response pattern.

to a change in the basal systolic blood pressure level is shown by the fact that on both the first and third day his basal readings were identical.

Figure 2 illustrates on another patient a decrease in reactivity between the first and the fourth day. While in the former instance (4–19–57) the patient's response was normoreactive (group II–III) and he reached the basal resting level in nine minutes, in the latter a sustained hyporeactive response (group V) was obtained.

Figure 3 illustrates a change from a hyperreactive response (group IV) to a normoreactive response (group II–III) on the following day. In both instances the basal resting levels were 115 mm Hg. Figure 3 also illustrates some of the difficulties of classifying the response patterns. A rebound of only 5 mm Hg or less was arbitrarily considered to fall within the normoreactive range of response patterns. It will be noted that the rebound on the day before was 15 mm Hg.

The ambiguous nature of some of the response patterns is further illustrated in Figure 4, when over a period of three days, the patient responded, first with a normoreactive pattern (group II–III), then with

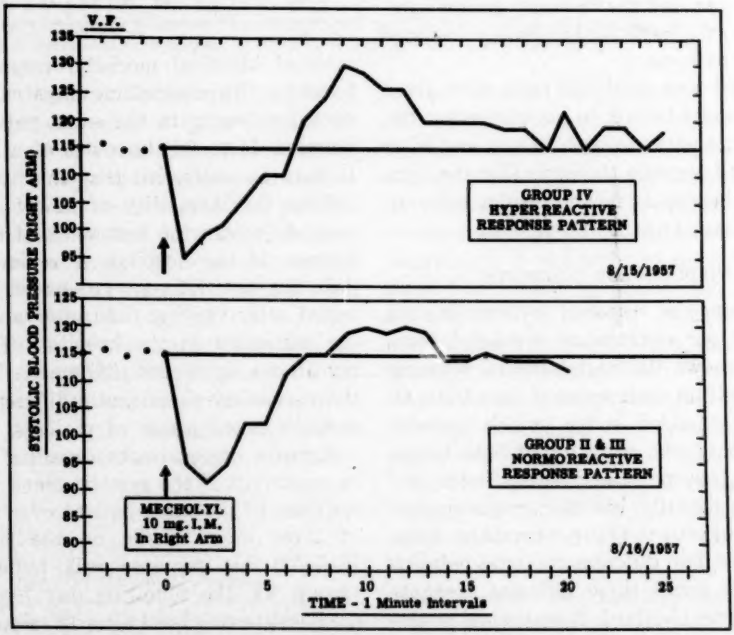

FIG. 3. A decrease of systolic blood pressure responses to mecholyl from a hyperreactive response pattern to a normoreactive response pattern.

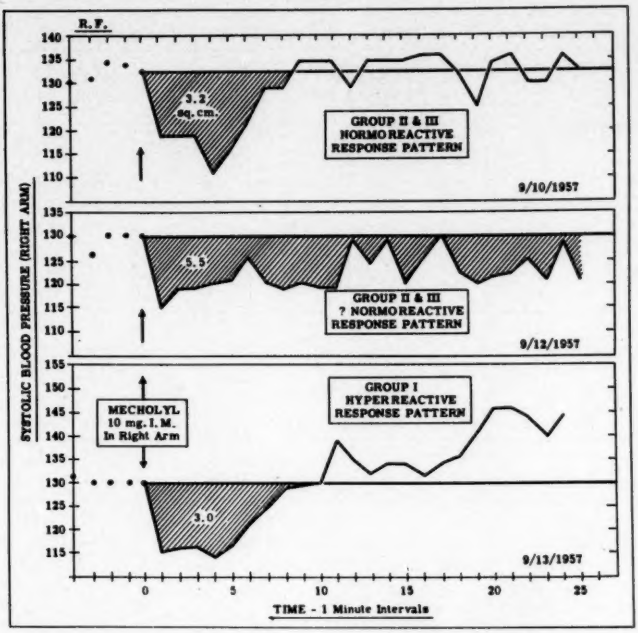

FIG. 4. Increase in systolic blood pressure responses to mecholyl from a normoreactive response pattern to a sustained hyperreactive response pattern. Illustration of "area" measurements.

a normoreactive pattern with some features of a hyporeactive response, and lastly with a clearly defined and sustained hyperreactive response (group I). Since on the second test his systolic blood pressure readings reached basal resting levels on more than one reading the response was classed as normoreactive. This tendency towards a hyporeactive response is in marked contrast to the sustained hyperreactive response on the following day where his systolic blood pressure rebounded to over 15 mm Hg above the resting basal level. Here, too, the basal blood pressure readings on both occasions were identical.

Table 4 summarizes the frequency distribution of all the 216 mecholyl response patterns which were recorded from both the right and left arms. Normoreactive responses (group II–III) comprised over 50 per cent of the total in both the pre-treatment and the post-treatment groups. It suggests that this response is not present in only a minority of schizophrenic patients (12) and that its incidence is not significantly different in such patients before and after somatic therapy.

Reliability of "area" measurements. As has been illustrated above, some responses are ambiguous and difficult to classify into response patterns. To compensate for the arbitrary nature of the classification, the area below the base line, enclosed by the systolic blood pressure curve, has been used as a more accurate and quantifiable index of mecholyl response patterns (13). In order to reflect a basic psychological or physiological characteristic of the individual the area should not change substantially from day to day or be different for each arm. To assess the reliability of this measurement, with regard to the former criterion, it was necessary to assume: (a) that there is a "true" area for an individual under

TABLE 4

Frequency Distribution of the Different Types of Responses to Mecholyl in Both Arms

Type of Response Pattern	Distribution in Series Taken Before Treatment			Distribution in Series Taken After Treatment			Total Incidence of Different Response Patterns	
	Number		%	Number		%	Number	%
	R	L		R	L			
Group I	14	2	11	6	0	8	22	10
Group II & III	56	20	54	34	7	54	117	54
Group IV	31	9	29	17	9	34	66	31
Group V	7	1	6	3	0	4	11	5
Total Number of Responses	140			76			216	

TABLE 5

Reliability of the Mecholyl Test in Terms of "Areas" Obtained from the Response Patterns

Item	Before Treatment (The first 25 patients only)	After Treatment (The first 12 patients only)
"Between" Mean Square	15.20 (24 d.f.)	8.61 (11 d.f.)
"Within" Mean Square	2.17 (75 d.f.)	1.61 (36 d.f.)
Test of Homogeneity of "Within Series Variances"	X^2(24 d.f.) = 60.83 $p < .001$	X^2(11 d.f.) = 21.60 $.02 < p < .05$
Estimated Coefficient of Reliability	0.60	0.52

similar conditions, and that the observed areas obtained at different times under similar conditions represent varying discrepancies from this "true" area; (b) that the discrepancies from the "true" area are normally distributed with a mean of zero (20). The variability of these discrepancies is then an index of the consistency or "reliability" of this type of measurement.

Table 5 summarizes the results for the pre- and the post-treatment groups.

The variation of the four area measurements obtained on four consecutive responses in each subject combine to give the "within" mean squares, which are thus estimates of the variability of discrepancies referred to above. The "between" mean square is a function of the variability from subject to subject of the averages of the four areas observed for each subject. The third line is a test which compares the variances within the 25 (or 12) series of four areas from a given subject under similar conditions. The coefficient of reliability (fourth line) estimates the ratio of the variability of "true" areas to the variability of observed areas.

The calculated coefficient of reliability and the tests of the "within-series variances" indicate a relatively low degree of reliability (26) and a lack of homogeneity (31). In the before treatment group, for instance, so much dissimilarity between the 25 "within-series variances" would occur by chance less than one time in a thousand. Each subject, therefore, presents an individual problem. The number of area measurements needed for each individual would depend upon the stability of the measurements and the degree of accuracy which is required in an estimate of the "true" area. For practical purposes such conditions amount to no reliability at all.

It is also worth noting that different response patterns in the same subject may be associated with closely similar "areas", while identical response patterns may present less similar measurements of "areas."

Figure 4 presents such an example. The first normoreactive response pattern and the hyperreactive response pattern have "areas" of 3.2 and 3.0 square centimeters respectively. The "areas" of the two normoreactive response patterns, on the other hand, measure 3.2 and 5.5 square centimeters. Such findings contradict the idea that the "areas" can serve as an accurate index of the response patterns. They may not at all differentiate between the normoreactive response pattern (group II–III) and the two groups which comprise the hyperreactive response patterns.

Systolic blood pressure responses to mecholyl recorded simultaneously in both arms. The senior author and his research assistant recorded simultaneously and bilaterally 48 mecholyl tests in 12 patients. The intramuscular injection of mecholyl was given into the right deltoid in each instance, and each operator always recorded the responses from the same side.

Table 6 summarizes the results of this procedure. In 15 instances (31 per cent) the response patterns in the two arms were dissimilar. Only one patient of the 12 who were subjected to four test bilateral determinations showed identical response patterns in both arms in all four tests. Eight patients showed one dissimilar response pattern out of four, two patients two dissimilar response patterns, and one patient three dissimilar bilateral response patterns. The difference appeared to be arbitrary and unrelated to the side into which mecholyl was injected. This, too, raises serious questions as to the meaning of this test.

Figures 5 and 6 illustrate an ambiguous response and an anomalous response respectively. The systolic blood pressure from the right arm is recorded on the left margin and from the left arm on the right margin. The base line consists of the superimposed basal readings from the two arms. In figure 5 the two response patterns approximate in shape, but while the right-sided response is clearly hyperreactive, the left-sided response is ambiguous though closer to a normoreactive than to a hyporeactive response pattern. In figure 6, for reasons that are not entirely clear, the injection of mecholyl was followed by a marked hyperreactive response in the left arm and no drop in the

TABLE 6

Concordance of Response Patterns between Simultaneously Recorded Readings from Right and Left Arms

	Same Response Patterns in Both Arms	Response Patterns Not the Same in Both Arms	Total Number of Bilateral Tests
Number of Simultaneous Right-Left Readings	33	15	48
Percentage	68.7	31.3	100

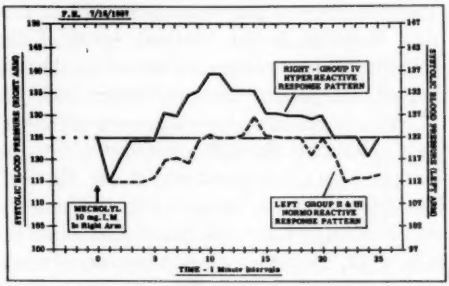
RIGHT - GROUP IV HYPERREACTIVE RESPONSE PATTERN
LEFT GROUP II & III NORMOREACTIVE RESPONSE PATTERN
MECHOLYL 10 mg. I.M. in Right Arm
SYSTOLIC BLOOD PRESSURE RIGHT ARM
SYSTOLIC BLOOD PRESSURE LEFT ARM
TIME - 1 Minute Intervals

FIG. 5. Dissimilarity between simultaneous bilateral mecholyl response determinations. Right arm: hyperreactive response pattern. Left arm: normoreactive response pattern.

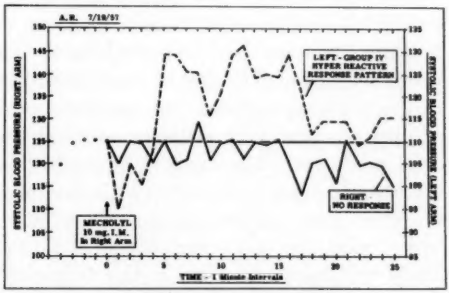
LEFT - GROUP IV HYPERREACTIVE RESPONSE PATTERN
RIGHT NO RESPONSE
MECHOLYL 10 mg. I.M. in Right Arm
SYSTOLIC BLOOD PRESSURE RIGHT ARM
SYSTOLIC BLOOD PRESSURE LEFT ARM
TIME - 1 Minute Intervals

FIG. 6. Dissimilarity between simultaneous bilateral mecholyl response determinations. Right arm: anomalous response pattern. Left arm: hyperreactive response pattern.

systolic blood pressure reading and no classifiable response pattern in the right arm. This raises interesting and important physiological questions, but a discussion of this aspect of the problem is beyond the scope of this paper. In this context it merely adds further evidence of the inconsistencies which are associated with this test.

DISCUSSION

Attempts have been made to correlate the mecholyl response patterns with a variety of mental and emotional conditions. They have been proposed as an aid in further delineating the clinical state of the psychiatric patient among others in the following categories: his diagnostic class (3, 17, 38), his basic psychodynamic make up (3, 15, 22), his thought processes (30), and his prospects for recovery (2, 6, 33, 35). They are said to indicate the type of somatic therapy best suited in a particular instance (2, 12), and when repeated over an interval of time, to offer the clinician a physiological index of therapeutic progress (40). As already stated, there is no unanimity concerning these correlations and in some instances frankly contradictory observations have been published. In view of findings such as those reported here, this is not surprising. The day to day variability in the response patterns precludes the possibility of classifying patients on the basis of a single test. The marked instability of the response also contrasts with the presumably more stable characteristics with which they are being correlated. It is unlikely that such correlates as the diagnostic class, prognosis, and basic psychodynamic make up, for example, could undergo similar fluctuations from day to day. The picture is further complicated by finding dissimilar response patterns in both arms. Also, as has been illustrated by some of the examples given, the "areas" enclosed by the systolic blood pressure curve below the base line, far from presenting a more quantifiable index of the response patterns, may, under certain circumstances, produce further inconsistencies in interpretation. As it stands, the mecholyl test is too unreliable (28), and what value it may hold for the clinician has yet to be determined.

The assumptions which underlie the uses to which this test has been put in psychiatry can be reduced to three basic propositions. They are:

1. That the responses of the systolic blood pressure to mecholyl are indicative of the autonomic balance within the circulatory system;

2. That the responses of the circulatory system to stimuli offer a reliable index of the state of the autonomic system as a whole;

3. That a defined causal relationship exists between the psychic states and the state of the autonomic nervous system.

Dealing with the first proposition, one may first point out that some of the inconsistencies in the results may be due to variables which are incidental to the method of administering the test. Observer error and route of administration of mecholyl are two such variables. With regard to the former, a higher concordance between two consecutive tests has been reported when both readings were undertaken by the same observer (39). It is possible that this observer error may, in part at least, account for the dissimilar patterns obtained simultaneously in both arms in eleven of the twelve patients who were studied through simultaneous bilateral determinations. No less important, however, are the variations caused by differences in the speed of absorption of the drug when it is administered intramuscularly or subcutaneously (18). This affects the response pattern and the "area" by influencing the magnitude and duration of the hypotensive effect (7). This would, in addition, be further influenced by any changes which the drug might undergo in the tissues prior to reaching the blood stream.

Although automatic or intra-arterial

blood pressure recordings and intravenous administration of acetyl choline may eliminate these particular variables, one must still inquire about what can be expected even with improved techniques of performing such a test.

It has been proposed that the systolic blood pressure response to mecholyl is a test of autonomic function. Two theories are currently offered to account for this relationship. One suggests that it reflects the state of central sympathetic reactivity in the hypothalamus, the adrenal medulla providing the responsive end organ to such reactivity (16). Experimental evidence for this view is based largely on work performed on isolated mammalian systems in the laboratory. No activation of the hypothalamic-adrenal axis by mecholyl in humans has yet been determined (38). The other theory, stressing peripheral states rather than central influences, proposes that the different response patterns reflect the relative adrenalin and noradrenalin levels in the blood (10). This view is supported by the finding that during intravenous infusion of adrenaline, mecholyl tends to produce a sustained hypotensive response in the subject while during noradrenaline infusion this is not true (14). It is important to bear in mind, however, that such infusions cause, among other effects, varying and widespread disturbances in the composition of the extracellular fluids and in the circulation (4, 9, 21). These disturbances in the physiological equilibrium of the so called resting state are not necessarily identical for the two substances. Besides, neither theory can account for the dissimilarity between the response patterns in the two arms nor for such phenomena as the marked hypotensive effect of mecholyl in Addison's disease (34).

The concepts underlying studies of the autonomic nervous system based on changes produced in the circulation after the injection of sympathomimetic or parasympathomimetic drugs have been subjected to severe criticism (4). A great variety of factors are involved. Apart from the autonomic state, they include oxygen-carbon-dioxide levels, hormonal effects and the influence of active intermediary and end-product metabolites (24). The response is influenced by the activity of the enzymes which inactivate or destroy the drug, the reactivity of the end organs, and the reactivity of some of the autonomic ganglia (4). None of these factors can be effectively isolated in the living organism from the total sum of concurrent mechanisms. As a practical illustration of the complexity of this problem, one may point to some of the paradoxical effects which mecholyl has been observed to exert on the same tissue under different conditions. Gastric motility, for example, will be affected by mecholyl differently when the stomach is in a state of contraction than when it is in a state of relaxation (1). In an analogous manner, it is not inconceivable that parts of the vascular system should at times respond in different fashion to the same stimulus.

The second proposition which is intimately involved in a test of this nature concerns the assumption that the responses of a single autonomic system may be legitimately considered to represent the autonomic state as a whole. The mecholyl test is but a measure of systolic blood pressure changes. Granting for purposes of theoretical argument, and despite evidence to the contrary, that the responses of the systolic blood pressure to mecholyl accurately represent the autonomic state governing the vascular system, then it still remains to be shown that a measure of the conditions prevailing in this system are an adequate representation of the autonomic system of which it forms but a part. The hypothesized close association between emotional and mental states and the state of autonomic centers in the hypothalamus can only be visualized as reflected through single system responses if these responses

hold general validity for the whole autonomic state.

Forty years ago, Eppinger and Hess (11) postulated the existence of overall sympathicotonic and vagotonic states. Such a simplified view of the function of and relationship between the two components of the vegetative system is no longer tenable. The respective influences which they exercise are not always antagonistic nor are they distributed uniformly and to an equal extent in all the systems and organs of the body. In fact, Eppinger and Hess themselves described such a phenomenon as local vagotonia. Thus, the either-or concept of autonomic function has been superceded by the concept of autonomic patterns with relative dominance in some systems or parameters of sympathetic and in others of parasympathetic function (8, 43). This view receives strong support from simultaneous measurements of such autonomic indices as blood pressure, pulse rate, glandular secretions, sweating, and others. These autonomic part-patterns have been shown to exist already in new-born infants (19) and are not necessarily constant even in the same individual. Thus, while it may be possible to state for a given subject that at a certain instant the sum of the measurements of such and such indices points to a total relative dominance of either the sympathetic or the parasympathetic components, it cannot be concluded from this that such a dominance is present in each of the indices which have been utilized. Also, the greater the number of indices used the more complete is the picture of the autonomic part-patterns. *In fine*, no single autonomic index, such as blood pressure responses, can justifiably be said to reflect the autonomic state of the organism as a whole (6, 8).

A review which would do justice to the pros and cons surrounding the last proposition is beyond the scope of this paper. Yet one may speculate that ultimately this will be the most crucial of the issues so far discussed. The measurement and adequate expression of mental and emotional states in terms of quantifiable physiological variables would represent a practical scientific advance of great importance. The James-Lange theory of emotions (5, 42) which postulated that emotions are expressions of the vegetative state, laid down a frame of reference which, up to this day, continues to be a subject of research and controversy. The idealistic view, as epitomized by Sherrington (36), that "visceral expression of emotion is secondary to the cerebral action occurring with the psychical state," is in its simple form as untenable as is, for example, Kempf's (23) view that "emotions have a peripheral origin in certain motor-sensory functions of the autonomic apparatus." A compromise solution to the question of the origin of the emotional state was offered by Papez (32) who proposed the existence of a closed neuronal circuit involving parts of the hypothalamus, the anterior thalamic nuclei, the cingulate gyrus, the hippocampus and fornix. The cingulate gyrus was considered to be receptive region for the experiencing of emotions which originated as impulses in the hypothalamus; through radiation to the cerebral cortex the cingulate gyrus would add affective tone to the psychic processes occurring elsewhere. This circuit, Papez proposed, would explain how emotion may arise in two ways: as a result of psychic activity and as a result of hypothalamic activity. At present even this concept is not adequate and it is probable that the phenomena of emotion are mediated over far more complex circuits than this (41).

As has been remarked elsewhere and in another context, the most reasonable position seems to be one which accepts the distinction between the physical and the mental, because one cannot escape making it, but does not sustain a prejudice about the nature of this distinction, and is ready to concede that just as there are differences between the two aspects there are also like-

nesses (29). Mental and emotional states involve the most complex levels of function. Though they may perhaps in certain areas and in a complex manner be inseparable from the autonomic state, little would be gained by actually identifying them with it.

To summarize the points brought out in the discussion one can say that two of the three basic propositions which underlie the proposed applicabilities of the mecholyl test in the psychiatric field are incompatible with experimental findings and current concepts: the responses of the systolic blood pressure to mecholyl can be considered no more indicative of the autonomic state within the circulatory system than responses of a single autonomic system can be considered indicative of the autonomic state as a whole. With regard to the third proposition, studies of the interrelation between the autonomic states and emotional conditions continue to reveal an ever increasing complexity of the problem. There certainly is no ground for simply assuming a functional identity of the two.

SUMMARY

The stability and reproducibility of the mecholyl test were investigated by subjecting 33 psychiatric in-patients at an acute psychiatric treatment and research center to a total of 216 mecholyl test readings. Series of four mecholyl tests under similar experimental conditions were given within a period of one week to 18 patients before, to six patients after, and to nine patients both before and after a course of somatic therapies. In 12 patients, 48 mecholyl test responses were read simultaneously, always by the same two observers from both right and left arms.

In 54 four-mecholyl-test series, consistently identical response patterns were present only in 8 series. In 39 series two different patterns, and in seven series three different response patterns were obtained. A similar degree of variability was present in the areas enclosed by the systolic blood pressure curves below the base line.

In the 12 patients who were submitted to simultaneous bilateral blood pressure recordings, 11 showed dissimilar responses in both arms in at least one test out of four. Dissimilar bilateral response patterns were obtained in 15 of the 48 mecholyl tests. The differences appeared to be arbitrary and unrelated to the side into which mecholyl was injected.

Some of the uses to which the mecholyl test as an autonomic function test have been put in psychiatry are briefly enumerated. The lack of unanimity and contradictory findings in the literature are discussed in the light of experimental evidence presented, and in terms of the following three assumptions which underlie the proposed applicability of the mecholyl test in psychiatry. They are: 1. that the responses of the systolic blood pressure to mecholyl are indicative of the autonomic balance within the circulatory system; 2. that the responses of the circulatory system to stimuli offer a reliable index of the state of the autonomic system as a whole; and 3. that a defined causal relationship exists between the psychic states and the state of the autonomic nervous system.

It is concluded on both experimental and theoretical grounds that the mecholyl test is unreliable as a clinical tool, at least in the type of patient studied, and is of no value as a meaningful index of the autonomic state.

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MECHOLYL CHLORIDE AS A PROGNOSTIC TEST IN PSYCHIATRIC PATIENTS

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Since Funkenstein's original publication in 1948, interest in blood pressure change following the administration of parasympathomimetic and sympathomimetic drugs as a method of predicting therapeutic response has been evidenced by many studies. These studies have included several types of patients. Funkenstein (4, 7) tested acutely psychotic patients selected for electric shock treatment. Hirchstein (10) and Geocaris (8) studied chronic schizophrenic patients. Some investigators have used Funkenstein's grouping of response, and Sloane *et al* (15) have used other variables of the blood pressure responses. Funkenstein's (6) subjects were hypertensive at time of testing. Other investigators have not specified whether the subjects were hypertensive or not.

Jones (11) tested patients prior to treatment and the test results were used as an indication for treatment. Hirchstein (10) used psychological behavior ratings, and Elmadjian (3) attempted to correlate these autonomic responses with the excretion of epinephrine and nor-epinephrine in the urine. Apparently the effects of the subject's age and vascular status on the blood pressure response to the stress applied has not been fully considered and correlated with the findings.

PURPOSE

In this study, our purpose was to record variations in blood pressure following mecholyl chloride injection in newly admitted patients and to determine whether these observations could be correlated with the diagnosis, prognosis, and response to therapy reported at the time of discharge. The number of patients requiring psychiatric treatment and the limitation of these services require a persistent search for more exact methods of rapidly determining the treatability of new admissions.

METHOD

Data concerning age, length of illness before hospitalization, physical and psychiatric diagnoses, length of hospitalization at this institution, principal type of therapy, and degrees of impairment on admission and discharge were collected independently of the treatment of the patient. Test results were not made known to the clinical staff in order to eliminate any influence on choice of treatment and ratings of improvement.

The admissions were from the following diagnostic groups: psychoneurotic reactions, psychotic reactions, and personality disturbances. The average length of hospitalization in this institution is three months.

The sample under investigation consisted of 100 patients, 49 male and 51 female, admitted to the adult inpatient service during a six month period. Successive admissions between the ages of 16 and 70 were tested, and only those for whom the test was contraindicated because of physical illness or extreme hyperactivity were excluded. Of those patients tested 37 were below 30 years of age, 54 were 30 to 60, and nine were over 60. The average age was 37.2 years. The patients were tested on an average of nine days after admission.

In our study the average systolic blood pressure was 116 and only four patients

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had a basal systolic reading over 140, whereas in Funkenstein's (6) study all patients tested had a systolic pressure over 140.

Mecholyl chloride 10 mg. was given intramuscularly. Epinephrine was not used, since previous investigators (12, 16) have stated that epinephrine does not supply meaningful additional information. The responses were classified according to Funkenstein groups.[2] Our Group V, therefore, includes Group VI, since only the epinephrine response differentiates between the two. Since Group V included only nine patients it did not seem of significance to divide them into smaller sub-groups. The procedure followed is outlined below:

The noon meal was served as usual. Patients began the rest period at 1 p.m., the sphygmomanometer cuffs were applied a few minutes before 2 p.m. and left in place. Blood pressure was recorded at 2 p.m. and repeated on three occasions at ten minute intervals.

Mecholyl 10 mg. in 1 cc. sterile distilled water was given intramuscularly after the fourth reading at 2:30 p.m. Blood pressures were then recorded every four minutes for 24 minutes. Notes were made of anxiety, dyspnea, chilling, tightness in chest, nasal congestion, substernal pain, pallor, flushing and sweating.

In recording the blood pressure, the systolic reading was recorded at the first sounds and the diastolic at the first change in tone. These were recorded to the nearest 5 mm. level. Atropine grs. 1/100 in solution was available each time mecholyl was given.[3] Although various nurses assisted with the testing, the same psychiatric nurse from the research department supervised the testing of each patient.

The blood pressure readings were plotted on graphs and classified according to the criteria recommended by Funkenstein (4) for mecholyl responses.[2]

In 49 patients none of the blood pressure readings after injection varied more than 10 mm. from the base line. These were initially considered a separate group, but since nothing significant was found in these patients, and the total results were not altered by including them in Groups II and III, this was done (8). Any significance that this minimal response to mecholyl might have would again be evident in our other blood pressure criteria: The basal blood pressure was taken as the control reading after a 90 minute period of bedrest; this was also considered the base line. The initial fall in blood pressure was taken as the maximum deviation below the base line which occurred within the first four minutes. The maximum change within the period after injection was the difference between the highest blood pressure reading obtained and the lowest.

CLASSIFICATION OF PATIENTS

The patients were classified according to length of illness before hospitalization in one of the four following categories: (1) *acute,* three months or less, (2) *sub-acute,* four through twelve months, (3) *sub-chronic,* more than one but less than five years, and (4) *chronic,* more than five years.

The psychiatric diagnosis was the dis-

[2] *Group I:* Slight fall in systolic blood pressure with early rise above base line and failure to return to it during the 25 minute observation period. *Group II:* Moderate or slight fall with or without slight rise above base line and then return within 25 minutes to it and maintenance of it. *Group III:* Moderate fall without rise above base line, but return to baseline within 25 minutes and maintenance of it. *Group IV:* Moderate fall with compensatory delayed rise before return to base line, and maintenance of base line. *Group V:* Marked fall with failure to reach base line within 25 minute period. *Group VI:* Same as *Group V,* except a greater rise using epinephrine. *Group VII:* Unable to obtain accurate readings because of chill. (4), pp. 411–12.

[3] One male patient, age 72, became cyanotic after the mecholyl injection and required atropine grs. 1/100 intravenously which immediately reversed the effects of mecholyl. (This patient has been excluded from the Funkenstein groupings.)

charge diagnosis made by the clinical director and the resident treating the patient. The degree of impairment at the time of admission and again at the time of discharge was evaluated according to established criteria.[4] The degrees of impairment were the result of two independent estimates made each time by the resident assigned to the patient and the resident conducting the study. The degree of improvement was obtained by finding the difference between these two numbers.[5] This improvement reflects the change during the period of hospitalization, which averaged 2.2 months.

This improvement rating would favor the acutely psychotic patient amenable to physical therapies because the maximum improvement rating could be obtained only by those who were maximally impaired on admission. The therapeutic function of this hospital would favor the same group since these patients are more adequately treated within a brief period of hospitalization. Therefore, this improvement rating was considered to be adequate for the sample.

[4] The degree of psychiatric impairment as described in the Diagnostic and Statistical Manual Mental Disorders of the American Psychiatric Association was used. Then degrees were graded from one to five, corresponding "no impairment" to one and "severe impairment" to five. (2), p. 49.

[5] Another scale was also used in which the difference between the degrees of impairment five and four was given the value of one; between four and three the value of two; between three and two the value of four; and between two and one the value of eight; on the assumption that improvement in the lower range of the scale is of greater significance. The following table illustrates the degree of impairment on admission as compared with the average degree of improvement on both of the scales:

Impairment on Admission	Number in Group	Improvement on Scale I	Improvement on Scale II
1	2	0	0
2	6	.33	2.66
3	18	.84	4.22
4	23	1.04	4.0
5	51	1.94	4.5

Both scales were tried and correlations between the other variables and the two improvement ratings were not significantly different, therefore the first scale was used.

RESULTS

CORRELATION OF FUNKENSTEIN GROUPS AND IMPROVEMENT

In this study Group VI was included with Group V since epinephrine was not used. No Group VII type of reactions were observed. Because 49 patients showed very little blood pressure variation, and some others atypical patterns, difficulty was encountered in classifying according to Funkenstein groupings.

Table 1 illustrates the Funkenstein groupings and the average degree of improvement for each group. The observations made in this study did not show a correlation between improvement and Funkenstein groups.

The Funkenstein groups in our sample as compared with those in studies by Funkenstein and by Geocaris (8) show that our Groups I and IV were larger than others, Group II was intermediate. This may reflect the difference in our sample but may also indicate the difficulty in classifying according to the Funkenstein groups.

BLOOD PRESSURE RESPONSE ACCORDING TO DIAGNOSTIC GROUPING

Sloane *et al.* (15) found that a group of patients with endogenous depression is differentiated from one of schizophrenia by showing a greater and longer fall of blood pressure to mecholyl, and that schizophrenics are differentiated from a group of neurotic patients by showing a pronounced secondary rise of blood pressure. Our findings show a similar trend but the difference between the diagnostic groups was not significant. Table 2 illustrates these findings.

The difference between the diagnostic groupings was not significant in our sample.

Schizophrenic Reactions. There were 28 patients in this group, with an average age

TABLE 1

Funkenstein Groupings and Patient Improvement

Funkenstein Groups	Number Patients in Groups	Degree of Improvement
I	20	1.4
II–III	56	1.19
IV	14	1.26
V	9	1.88

TABLE 2

Comparison Between Obtained Mean Blood Pressure Measurements and Sloane's (in parentheses)

	Depressives		Neurotics		Schizophrenics	
Maximum fall	(22.45)	13.6	(14.21)	10.0	(10.38)	8.2
Maximum secondary rise	(6.82)	1.4	(4.62)	5.0	(10.71)	9.2

of 29.9 and an average degree of improvement 1.36. The diagnoses and lengths of illness seemed to differentiate between prognostically good and poor cases according to the usual expectations, which strengthened the impression that the improvement ratings used were valid. These criteria seemed to be the best indicators of improvement in this group, as shown by Tables 3 and 4.

All Funkenstein groups showed similar degrees of improvement, thus did not distinguish between prognostically good or poor cases, as illustrated by Table 5.

"Initial drop" subtracted from change within the period gave "over-compensatory" rise or the rise above the base line. In these groupings, the "over-compensatory" rise showed the difference in degree of improvement. This difference was significant at the 10 per cent level of confidence.[6]

In Table 6 the patients were grouped according to age (above or below 30 years),

[6] The results obtained were as follows:

Over-Compensatory Rise	Number in Group	Degree of Improvement
5 or less	12	.75
10 and above	16	1.8

TABLE 3

Improvement by Type of Schizophrenic Reaction

Schizophrenic Reactions: types	No. in Group	Degree of Improvement
Hebephrenic	3	0
Catatonic	3	2.0
Paranoid	9	1.22
Acute Undifferentiated	6	2.83
Chronic Undifferentiated	7	.57

$X^2 = 16.74$; $P < 0.01$.

TABLE 4

Improvement of Schizophrenic Group by Length of Illness

Length of Illness	No. in Group	Degree of Improvement
Acute, 3 mos. or less	10	2.1
Sub-acute, 3 to 12 mos.	0	
Sub-chronic, 1 to 5 yrs.	7	1.0
Chronic, over 5 years	11	.91

$X^2 = 8.02$; $P < 0.01$.

TABLE 5

Improvement of Schizophrenic Patients by Funkenstein Groups

Funkenstein Group	No. in Group	Degree of Improvement
I	10	1.6
II–III	13	1.6
IV	5	1.59
V	0	0

TABLE 6

Schizophrenic Group by Age and Chronicity

	Maximum Change	Degree of Improvement	Base Blood Pressure	No. in Group	Initial Blood Pressure Drop	Funkenstein Group
below 30, acute	27.5	2.75	106/73	4	12.5	I-2, II-2
below 30, chronic	15.4	.5	121/73	12	7.9	I-3, II-7, IV-2
above 30, acute	15	1.8	114/78	5	4.0	I-2, II-2, IV-1
above 30, chronic	17.1	1.7	121/77	7	8.6	I-3, II-2, IV-2

TABLE 7

Improvement of Involutional Patients by Funkenstein Groups

Funkenstein Groups	No. in Group	Percentage	Degree of Improvement
I	1	7.1	1.0
II–III	8	57.2	2.87
IV	1	7.1	3.0
V	4	28.6	2.75

TABLE 8

Involutional Group by Degree of Improvement

Degree of Improvement	No. in Group	Average Age	Change w/in period	Initial Drop	Base Blood Pressure
1 & 2	6	50.5	12.5	8.3	120/90
3 & 4	8	58.8	16.9	17.5	127/70

TABLE 9

Involutional EST Group by Degree of Improvement

Degree of Improvement	No in Group	Average Age	Base Blood Pressure	Initial Drop	Funkenstein Groups
1 & 2	4	50.7	114/71	5.0	I-1, II, III-3
3 & 4	7	58.5	122/69	16.4	II-4, IV-1, V-2

as to chronicity, as to blood pressure response (base reading, initial drop and maximum change) and according to Funkenstein Groups.

Chronic patients under 30 years of age showed by far the poorest prognosis. None of the other variables was significant. Acute patients below 30 showed by far the best improvement, and also showed the lowest basal blood pressure, the highest "initial drop" and the highest maximum change. Of the different treatments, chemotherapy showed the best results (2.0), insulin the next best (1.62) and electric shock treatment the poorest (0.88).[7]

[7] Comparing the results of therapies in schizophrenia, hebephrenic patients showed no improvement on any therapy. The catatonics showed equally good improvement on chemotherapy and electric shock treatment. In the paranoid group, the one patient given chemotherapy responded well and the five given insulin also showed a good response. In the acute undifferentiated group, chemotherapy, electric shock treatment, and insulin showed equally good results. Insulin seemed to be slightly more effective than electric shock treatment and insulin in the chronic undifferentiated. In the acute group, those treated with chemotherapy showed by far the best improvement. In the sub-chronic group, those treated with insulin were the only patients that showed improvement, and they showed a high degree of improvement. In the chronic group, chemotherapy and insulin showed approximately the same effect.

Involutional Psychotic Reactions. In the involutional group, composed of 14 patients whose average age was 55.3 years, if the patients were grouped according to Funkenstein's system, those patients falling in Groups II through IV showed the same degree of improvement. Only the one patient whose response placed him in Group I showed a different degree of improvement. Therefore, no correlation between Funkenstein's grouping and improvement was evident in 13 of these 14 patients (Table 7).

The relation (t test) between improvement rating and age, "initial drop", and base line blood pressure was significant at the 5 per cent level of confidence. Change in blood pressure within period of test was not significant. These correlations indicate that older people with "labile hypertension" have the highest degree of improvement, as shown in Table 8.

Results of this investigation were similar to those reported by Funkenstein (6) who found that of the patients with elevated blood pressures readily reduced by mecholyl, 93 per cent responded to electric shock therapy.

In the 11 involutional psychotic patients treated with electric shock, Funkenstein Group V showed a good prognosis, whereas Groups II–III did not separate the improved from the non-improved, as shown in Table 9.

Affective Reactions. This group has an overall good prognosis, and our measurements did not distinguish the improved from

the non-improved. The few differences found were not statistically significant.

Psychoneurotic Disorders. In this group differences between the Funkenstein groups were not significant. The acute group displayed a tendency toward better prognosis than the others, although none of the variables could be significantly related with degree of improvement.

Personality Disorders. None of the measurements used differentiated the improved from the non-improved.

DISCUSSION

The pharmacologic action of mecholyl on the cardiovascular system, according to Goodman and Gilman (9) is peripheral vasodilation leading to blood pressure fall and tachycardia. This effect gives rise to the initial drop in blood pressure after injection, and the subsequent changes are brought about by compensatory or homeostatic mechanisms. Therefore, the "normal" curve consists of an initial drop of systolic blood pressure within the first few minutes, and shortly thereafter the compensatory mechanism may bring the blood pressure slightly above the base line. The second phase of the blood pressure response may be seen as indicative of the state of the compensatory (homeostatic) mechanisms.

Assuming as does Selye (13), that neuropsychiatric disorders are diseases of adaptation and considering the important roles the sympathetic nervous system and adrenals play in the general adaptation syndrome, the blood pressure response to mecholyl may be used to indicate the state of stress response. These theories then offer a theoretical framework for interpreting the blood pressure responses.

Diagnosis, duration of illness, and clinically determined prognosis showed positive correlations with the improvement rating. Too, the patients who improved showed a greater "compensatory rise" than the unimproved.

In the treatment of the schizophrenic subgroup, chemotherapy was most effective, insulin was intermediate, and electric shock treatment was least effective. In the psychoneurotic subgroup, those rated "acute" were much more responsive to treatment than the others. None of the other variables was significant. In those with personality disorders none of the variables differentiated the patients who improved from those who did not.

In the involutional depressions, the Funkenstein groups did not differentiate the improved from the non-improved. However, the Funkenstein Group V showed the highest improvement rating; but the combined Groups II and III included an equal number of improved and non-improved.

SUMMARY

This study reports the findings of the blood pressure response to mecholyl chloride in 100 unselected patients. The mecholyl response was obtained prior to the instigation of treatment and the findings were not revealed to the physician responsible for the care of the patient. In addition to the measures recommended by Funkenstein, the initial change in blood pressure readings following the injection of mecholyl and the total variation in these readings as compared to the control were considered.

A significant positive correlation was found between the degree of improvement and the patient's age, basal blood pressure, and initial drop after injection of mecholyl chloride. This seemingly differentiates "labile hypertensives" as a prognostically good group.[8]

[8] Goodman and Gilman (9), p. 431: "In patients with essential or nephritic hypertension, a small dose of methacholine (2.5 mgm. subcutaneously) causes a moderate to marked decrease in blood pressure whereas the same dose has only a slight effect in normal persons, the percentile fall in pressure averaging three to four times that which occurs in normal controls. Even in hypertensive patients whose blood pressure decreases to normal during a control rest period, a greater percentile fall occurs, a fact which suggests that the disease itself and not the absolute level of the high blood pressure is the

In this study the grouping of blood pressure responses as suggested by Funkenstein did not show any correlation with improvement and it was impossible to categorize blood pressure response according to his method. However, when criteria which can be measured more easily and accurately are used, the mecholyl test seems valuable in relating prognosis with the "reactivity" or the ability to respond to the mecholyl stimulus either by a fall or a rise in blood pressure. Other investigators have also indicated this trend (1, 6, 10, 11, 12, 16).

No correlation was found between the Funkenstein groups and prognosis.

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important factor conditioning the decrease in tension noted after the drug. The cold pressor response in hypertensive patients is also reduced by the prior administration of methacholine. Apparently the peripheral vessels in patients with hypertension respond to the drug with a proportionally greater dilation than do those of normal persons."

CORRELATES AND CONSEQUENCES OF PATIENT INTERACTION AND ISOLATION IN A MENTAL HOSPITAL

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This paper is concerned with the interactional patterns of patients on the several wards of a mental hospital. It seeks to describe and analyze the interactional relationships of patient with patient and patient with various staff personnel and to relate these interpersonal relationships to a number of variables dealing with patient care, diagnosis and treatment.

The significance of this study lies in its attempt to focus attention on those aspects of both the psychiatric and sociological literature which tend to describe mental illness in terms of a breakdown or failure in normal interactional relationships (1, 2, 5, 10). For example, it has been suggested that interpersonal relationships necessarily involve the participants in reality testing situations and that for the mentally healthy person the interactional process supports and modifies existing perceptions in accordance with the realities of the situation (6, 8). By way of contrast the psychotic mental patient is viewed from this framework as being unable to relate himself meaningfully to others and to communicate effectively with them (7, 11). Consequently, his cognitive grasp of reality tends to be distorted and his perceptions are no longer real as defined by others nor shared meaningfully by others. In effect these distortions serve to further isolate the mentally ill person from satisfactory social relationships. In accordance with the postulates of this interpersonal approach, it has been maintained that a major goal of psychiatric therapy is to help the patient reestablish normal, meaningful and satisfying social relationships (9).

The usefulness of this interactional approach for the understanding of the behavior of patients and staff on wards of a mental hospital is the subject matter of this paper.

It is readily apparent, however, that the intensity and extent of interpersonal relationships is a matter of degree and that even among hospitalized mental patients interactional involvements vary perceptibly. This study is specifically concerned, therefore, with the varying degrees of patient interaction, and its correlates and consequences for both patient and staff functioning in a mental hospital. It is suggested on the basis of a previous paper that age, sex, length of hospitalization, room assignment and disease entity may be important correlates of the extent of patient interaction whereas ward administrative policies and practices may not (3). It is further hypothesized that the level of patient interaction is viewed by the staff as a diagnostic indicator in specifying the treatment program and the attitude and interest of the staff in the patients.

METHOD

In order to study patient interactional patterns and their correlates and consequences, two psychiatric aides with lengthy hospital experience were assigned the full time task of making periodic observations of the overt behavior and interactional involvement of each of the patients on each of the five hospital wards at the Columbus Psychiatric Institute and Hospital. The five wards were charted alternately on a fixed schedule. Recordings of patient behavior

[1] The Research Division, Columbus Psychiatric Institute and Hospital, and the Departments of Sociology and Psychiatry, the Ohio State University.

were made approximately every half hour over a period of seven and one-half hours every day (*i.e.*, from 9:00 A.M. until noon, 2:30 to 5:00 P.M. and 7:00 to 9:00 P.M.). These recordings were made for a three week period and were designed to provide a threefold description of patient activity in terms of (1) whether and with whom the patient was interacting, (2) the exact location of the patient on the ward, and (3) the nature of the behavior observed. By interaction is meant an overt behavioral act involving two or more persons in a situational context necessarily requiring close physical proximity and reciprocity of responses (*e.g.*, conversation, quiet games such as cards, checkers, etc.). These criteria precluded such aggregate activities as television viewing and the grouping of patients prior to meals or preceding such scheduled activities as occupational or recreational therapy.

A code system was devised to facilitate the analysis of the recordings and to indicate all three aspects simultaneously. For example, a code designation of 2-1-5 meant that the patient was (1) in close physical proximity with another patient(s) (the recording chart indicated just how many persons were involved in the given situation), (2) in the day room and (3) engaged in verbal communication.[2]

There were 147 patients (97 female and 50 male) on whom such observations were made. An average of 106–112 observations were recorded on all of the patients who were hospitalized for the entire three week period resulting in 11,879 patient-observations. A similar and simultaneous procedure was used in recording the activities of staff personnel.

For the purposes of this paper only the observations of the interactional activities of the 27 male and 62 female patients who were hospitalized for the length of the study were utilized. This was done to insure comparability of the data. On the basis of the frequency of their total interaction with other patients, both male and female patients were classified as either high (above median) or low (below median) interactors. High and low interactors on both the male and female wards were then compared in terms of their interaction in dyadic relationships, in group relationships and in nonscheduled interactions with physicians, nurses, student nurses and psychiatric aides. A composite interaction level was then computed for all of these forms of interaction.

An analysis was made of the characteristics (age, diagnosis, length of hospitalization) of high and low interactors and of the characteristics (weighted in terms of frequency of interaction) of the patients with whom they did and did not interact during the three week period. A special analysis was also undertaken of the relationship of room assignment (single, double and four bed dormitory) with frequency of interaction.

On the other end of the problem the level of interaction was correlated with the amount of time devoted to the discussion of patients at morning ward meetings which were attended regularly by two of the authors and at which they recorded all discussions. Similarly, the level of patient interaction was related to the type of therapy administered to the patient, to changes in diagnosis between hospital admission and discharge and to case outcome.

FINDINGS

General Patient Interaction. There were an average of 107.2 observations made on each of the 27 male patients and 104.3 recordings on each of the 62 female patients who were hospitalized during the entire length of the study. The male patients were involved in various scheduled activities (*e.g.*, psychotherapy, group therapy, occupational therapy) during 17.7 per cent of these observations while the female patients

[2] For a more detailed discussion of the recording procedures and behavioral categories utilized, see "The ward behavior of psychiatrically ill patients," *Social Problems*, Autumn, 1958, by the authors.

were so involved 29.6 per cent of the time. Of the remaining average of 89.22 non-scheduled observations on the males and 73.4 observations on the females it was found that:

(1) Female patients interacted significantly more often with each other than did the male patients. The respective median number of such interactions was 20.5 for the females and 16.0 for the males and the respective ranges were 2-58 and 4-46 interactions.

(2) The median number of such patient-patient contacts was relatively constant within the three female and within the two male wards.

(3) On the male but not the female wards, patients who established frequent dyadic relations also were more frequently involved in group interactions on the ward (i.e., they were more often interacting with two or more patients at the same time). Thus, the rank order correlations between involvement in dyadic and group relationships was significant on the two male wards (+.77 and +.79) and not significant on the three female wards (+.38, +.17 and −.29).

(4) Female patients had a greater frequency of non-scheduled and informal contacts with psychiatrists, interns and medical students than did the male patients. This difference, however, was not statistically significant.

(5) Male patients interacted significantly more frequently with the rest of the ward personnel than did the female patients. These interactions included contacts with nurses, student nurses and psychiatric aides.

Using two indices of the level or frequency of interaction—the number of contacts with other patients and the composite number of contacts with patients and staff—male and female patients were classified as high or low interactors (above and below median). The high patient-patient interactors, both male and female, were also found to interact far more frequently with physicians, nurses, student nurses and with psychiatric aides. Not only was the frequency of these interpersonal relations in the expected directions but significant differences between the high and low interactors for both sexes were obtained with regard to the amount of contact with physicians, nurses and student nurses as well as for the males alone with regard to psychiatric aides.

In an attempt to determine some of the variables related to frequent or infrequent interpersonal relations on the ward, the high and low interactors were compared by age, length of hospital stay, working diagnosis and room assignment (whether single, double or dormitory). The findings indicate that only one of these variables was significantly related to the interaction level on either the male or the female wards. This occurred on the female wards where a significantly greater percentage of the high interactors had been diagnosed as non-psychotic whereas the majority of the low interactors had been classified as psychotic. Otherwise age, length of hospitalization prior to the study and room assignment appeared to be of little or no consequence for frequency of interaction.

Similarly, no significant differences were obtained when the characteristics of the patients with whom the high and low interactors did or did not associate were analyzed. Even when these characteristics were weighted by the frequency of the interactions no significant relationships were found. It appeared that patients were selected or rejected for interaction by each other quite independently of age, length of hospitalization or diagnosis. It was also found, of course, that the most frequent interactions occurred among the high interactors and that when the low interactors did associate with other patients it was almost invariably with the high interactors.

High and Low Interaction and Patient Care. If the frequency and nature of the interpersonal relationships of patients is as significant as has been postulated by Sullivan and others, then it should affect and be

reflected in the various aspects of treatment and care given patients. Four separate types of analysis were undertaken to test these postulated relationships. *First*, the hypothesis that the level of patient interaction is directly related to the amount of time devoted to formal staff discussion of the patient and his problems at morning staff conferences was tested and rejected. On both the only male and female units studied, the relationship between the total (patient-patient plus patient-staff) level of interaction and case discussion time was in the predicted direction but did not approach statistical significance. The total interaction-patient discussion correlation was +.58 on the male ward and +.04 on the female ward and slightly lower when only the level of patient-patient interaction was considered.

Second, there were two wards, one male and the other female, on which drug and shock therapies were more extensively utilized. It was hypothesized that the frequency of the use of these therapies would directly reflect the degree of patient isolation. In testing this hypothesis it was found to be reasonably predictive on the female but not on the male ward. On the female ward, nearly three-quarters of the low interactors were treated with chlorpromazine or electro-shock whereas only one in four of the high interactors received these therapies. Of course, the administration of these therapies could be both cause and effect of low interaction. Whether cause or effect, the use of these therapies was, however, non-discriminative of the interaction level of the patients on the male ward.

Third, it was thought that there would be a different direction in changes in diagnosis between admission and discharge for the high and low interactors. It was even more specifically postulated that the direction of these changes when made would be from schizophrenic to psychoneurotic and character trait disorder in the case of the high interactors and that the reverse would characterize the low interactors. Unfortunately, so few actual changes occurred that this hypothesis could not adequately be tested.

Finally, the type of discharge granted the patient was so uniformly listed as improved that there were, as a result, few distinctions between the high and low interactors in this respect.

DISCUSSION

These findings indicate that among mental patients, as among persons in general, there tend to be those whose patterns of association are quite restricted and those who are more gregarious and more frequently involved in interpersonal relationships with others. Within the mental hospital population studied, it was apparent that this quality or qualities of what might well be termed gregariousness is a generalized rather than a specific quality. Patients who interacted a great deal with other patients (whether singly or in groups) also had the greater contacts with every staff level, from the psychiatrists to the aides.

Significantly, female patients interacted more frequently with each other than with the staff while the males spent much of their interactional time with the staff. One highly plausible explanation for this difference in interactional pattern is that the male patients were interacting with relatively young women in their relationships with staff members, while on the wholly female staffed wards (apart from the psychiatrists and residents) the male-female attraction was lacking. In a situation in which the patients are not often very acutely disturbed, as the case at the Columbus Psychiatric Institute and Hospital, this sex attraction seems to be a very plausible explanation indeed.

On the other hand, there were no definitive social characteristics associated with the degree and frequency of interaction, nor of those who were frequently or infrequently selected or rejected as partners in interaction. Similarly, and with only an oc-

casional exception, the level of interaction seemed to have no bearing, when thought of as an independent variable, on case outcome, changes in diagnosis at admission and discharge, amount of time devoted to discussion of the case at regular thrice weekly staff conferences and to therapy. In the latter instance, the data on one female ward seemed at least to be in the predicted direction.

As a result of these findings many of the commonly accepted theories and treatment practices based on the theme that relative social isolation is almost tantamount to the absence of mental health or conversely to the severity of mental illness seem to have little merit so far as these moderately confused and disturbed patients are concerned (4, 7, 11). It is certainly possible and even probable that these theories would be easier to justify in an institution in which there are greater extremes in the severity of patient disturbances. It is also possible that a study involving a greater number of patients over a longer period of time would have had the same effect in this institution. Finally, a study of the nature and content of the interaction rather than its frequency might have provided some corroboration for the interpersonal theory of mental health and illness.

On the other hand, these findings, in spite of the limitations suggested above, may actually be indicative of certain personality components, previous experiences and cultural pressures to be found in and out of institutions, which are determinative of the degree to which they become involved in interpersonal relationships. These components may be largely independent of health or illness except, of course, in the most disturbed type of patients. If so, it would be necessary to have some knowledge of the interactional patterns of the patients prior to the onset of the illness in order to make valid generalizations about the role of social isolation as either correlate, cause or effect in mental illness and its treatment.

SUMMARY

In a study involving a series of over 100 observations for a three week period of the interactional patterns of each of 27 male and 62 female hospitalized mental patients, no very definitive correlates of patient-patient and patient-staff interaction were found. The general findings indicated that the frequency of patient-patient interaction was greater for females while patient-non-medical staff relationships were more frequent for the males. In addition high interactors, both male and female, were found not only to interact more frequently with other patients but with physicians, nurses, psychiatric aides and student nurses than did the low interactors. The interpersonal relationships of the low interactors were found to be more restricted with everyone. Neither age, length of hospital stay, diagnosis or room assignment were found to differentiate the high from the low interactors.

Similarly, and with only minor exceptions, the ward interaction of patients did not appear, on the basis of the data available, to be predictive of the type of release (improved-unimproved) given the patient, changes in diagnosis from time of admission to discharge, the type of treatment given the patient nor the amount of time devoted to the discussion of the case at regular, thrice weekly morning staff conferences.

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THE CONCEPT OF INTERPRETATION IN PSYCHOANALYSIS[1]

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Every day it is increasingly apparent that we must revise our knowledge of the basic factors in the therapeutic process of psychoanalysis, in order to improve our practical results. The experience acquired from the analysis of children and psychotics has enriched that already gained from the analysis of neurotics, and it opens new possibilities in the search for a substratum or common denominator, which in time ought to yield better understanding of our therapeutic conduct. The technical norms may vary in accord with the nature of the case and even in respect to the personal inclination of the analyst, but the fundamental process is unitary, whatever may be the field of psychoanalytic application. Understanding this process will make more exact the clinical indications for using analytic methods, perhaps extending them to new forms of pathology.

A good part of what takes place in the analytic process escapes the analyst's notice. The patient is cured not so much by what the analyst supposes he is doing with his conscious technical interventions, but mainly by what the analyst unconsciously does. Several analysts have noted the fact, which seems fairly common, of having obtained excellent therapeutic results in the first years of their professional life, when they as yet had very little technical knowledge. In the early period of my clinical activity, about thirty years ago, I also achieved very good results, which were not, I think, brought about by suggestion but were actual analytic cures, in the sense of a real and definitive reconstruction of the personality. The inadequacy of my technical information and even the insufficiency of the analytic rules of that time, which I consciously adopted, leave apparently without explanation what really happened. It does not seem to me to be a question of the pseudo–analytic effects noted by Glover (6) or the reactions of manic defense of which Joan Riviere speaks (12, p. 320). I believe it really deals with the constructive results of an intervention analytically correct, although not wholly expressed at a conscious level.

The decisive weapon of the psychoanalytic technique is interpretation. In his well known and excellent paper on "The nature of the therapeutic action of psychoanalysis", Strachey (18) makes clear that the ultimate operative factor in the process is that type of interpretation called by him "mutative", which leads the patient to confront and consequently to distinguish between the archaic object of his phantasy and the real object of the present which is the person of the analyst. Alexander reaches a similar conclusion when he affirms that the healing force of psychoanalysis is in that which he calls a "corrective emotional experience", which consists in a comparison between an infantile situation and the present one. In a desire for synthesis and in order to bring under one term phenomena of the same dynamic nature, I discussed in a previous work (9) the concept of "interpretative attitude", which includes any behavior of the analyst whose aim and consequence is to enable the patient to feel in a different way certain facts of his psychic life. The interpretative attitude offers to the patient a new version of these facts. It is this reinterpretation that produces corrective results.

The inspiring element of the interpretative attitude is counter–transference. It is this that produces in the analyst, at the un-

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conscious level, the group of identifications necessary to the development of the analytic process. Already in 1926, in a work that did not receive the notice it deserved, Helene Deutsch (3) pointed out the two types of identification that develop in the counter-transference situation: on the one hand, identification with the patient (with parts of the patient's ego) in his infantile position repeated in the analysis; on the other hand, identification with the patient's infantile objects (with parts of the patient's super-ego). The latter causes in the analyst what the quoted author calls a "complementary attitude". It is through the stimulus produced by the analyst's complementary attitude that the patient relives in the analysis the original infantile situation. In a lecture in 1955 in Sao Paulo, E. Racker again took up this conception of Helene Deutsch, calling "concordant identification" that of the analyst with the patient and "complementary identification" that which occurs with the patient's infantile objects (H. Deutsch's complementary attitude).

A closer examination of the structure of the complementary identification compels us, however, to distinguish two different and opposite phenomena. In the first place there is the identification with the patient's infantile object in the original situation repeated again in the analysis. In the second place there is the identification with the patient's infantile object needed for his maturation at that particular moment. The first identification favors the repetitive attitude of the patient, the second brings him to comparison and change. In the truly effective interpretation—that which Strachey calls mutative—the confronting does not occur, however, between phantasy and reality or between the past and the present. The confronting takes place between the phantasy which reproduces the original situation and another phantasy corresponding to a more mature phase in the development of the patient which he was unable to attain at the right time. It is not really the actual quality of the analyst which serves as a basis of comparison with the past, but that which, in his present attitude, he symbolizes as an infantile corrective object. It is a question then to present to the patient not the actual reality but, according to M. A. Sechehaye's expression in relation to the schizophrenic (15, p. 8), a new reality that he should have had in a certain period of his childhood. This is not only valid in schizophrenia itself but constitutes the basis for the psychoanalytic process in general.

Revising then the quoted article of Strachey (18), we see consequently that the auxiliary super-ego, that is, a part of the analyst introjected, as object, by the patient, is not characterized properly by the circumstances that "its advice to the ego is consistently based upon *real* and *contemporary* considerations" but by its quality to represent, in comparison with the archaic objects of the patient, another archaic object more appropriate to psychic maturity on the occasion of the infantile development which is relived in the analysis. Thus is explained the paradox pointed out by that author and indicated by the fact that the best way to ensure in the patient's ego a distinction between phantasy and reality is to "withhold reality from him as much as possible". The fact is that the pattern of reality which is useful at the moment is not really present reality but a past reality which, when it was needed, he could not grasp and assimilate.

The unconscious nature of the basic interpretative phenomenon is therefore inherent in this article of Strachey when he refers (p. 149) to "implicit" mutative interpretation through which there develops in the patient the useful analytic process, without this being brought about by any conscious intention on the part of the analyst. The analyst's behavior is, in truth, intuitive, and there is really no need that it should be conscious. This is one of the principal elements of the analytic work, an element that is essential in the analysis of

psychotics, but is also important for any analysis. For Sechehaye (15, p. 10), intuition constitutes the fundamental (although not sufficient) requisite of her method of "symbolic realization" for the treatment of schizophrenics. Frieda Fromm–Reichmann (5) also gives her experience on the clinical significance of the "intuitive process". It should be pointed out, too, that this has been the purpose of T. Reik's (10, 11) comprehension.

It is the variety of complementary identifications of the analyst which, being reflected in the patient, produce at each step of the analysis the progressive movement characteristic of the analytic process. Through the action of counter–transference, expressed in his interpretative attitude, the analyst makes it possible for the patient to meet successively his infantile objects which, in the natural development of the individual, are represented by the parents in conduct appropriate to each stage of evolution. To such a determined counter–transferred stimulus there corresponds in the patient the awakening of a new transference. According to what Sechehaye (16) teaches us in relation to schizophrenia, the transference is resolved by a series of other transferences, each new transference being more in contact with reality than the preceding one. It seems to me that this formula is not limited to schizophrenia but explains what takes place in any analysis.

The analyst teaches the patient then through the interpretative phenomenon to make contact with the past and to dominate it. He acts as the understanding parent who assists and encourages the child to grow up. This role is given to him by the supportive attitude which R. Spitz (17) calls "diatrophic". It derives from that "maternal fiber" of which Sechehaye (15, p. 13) tells us, which turns the analyst, according to the same author, into a "symbolic protector". Gertrude Schwing (14) describes by the name of "motherliness" this propitious quality of the analyst, whose details and working need to be studied with greater precision. In the counter–transference position the analyst makes the patient see that, like a parent who is really concerned for the welfare of his child, he does not want to exploit the situation in his own benefit but in favor of the patient himself.

In the transference, the infantile drama of conflict between dependence and independence is repeated at each moment. Analysis implies for the patient an option between two object relations, which are in together in the present but occurred at different times in the past. Interpretation is an invitation for change. It reaches its objective in proportion as the analyst succeeds in transmitting counter-transferentially the security necessary for the propulsive movement. In this sense its preeminent value grows out of its being an expression of understanding. According to what Rosen emphasizes (13, p. 140) in speaking of that type of interpretation which he calls "direct" the therapeutic utility of the interpretation depends on the fact that, in the unconscious part of his ego, the patient feels understood. The interpretation verifies for him that the analyst has been able to dominate the counter–transference anxiety, which proves that it is possible to deal with infantile impulses in a sure way. Barbara Low (8) expresses this very well by saying that the patient, as the child, feels that "since the superior one (the analyst) has been in a dangerous and painful position, but yet emerged, he can do likewise".

It was certainly this propulsive quality of the personal counter–transference of Freud which led him to abandon hypnosis—a method which explores above all the conditions of emotional immaturity of the patient—in order to create in its place the more advanced method of psychoanalysis. The experience of Bernheim, by which Freud was inspired, in correcting posthypnotic amnesia implied, however, for the patient, the corrective confrontation by two objects, which represented two opposite

attitudes assumed by the same doctor: one, authoritarian and imperative, which imposed on the patient subordination of an infantile type to the order that were given him; the other liberal and permissive, which stimulated him to act in a more adult way, that is, to conquer the resistances, thus freeing himself from these orders.

The fulfilling, on the part of the analyst, of the task which falls to him in the analysis, demands great flexibility in the counter-transference. This is one of the aspects which distinguishes analysis from the suggestive forms of psychotherapy, in which the role of the therapist is more stereotyped. The freezing of the analytic process by the accomodation of the patient to the continued repetition of a determined infantile situation in the transference, results, above all, from the fact that placing himself in a supposed real situation, the analyst does not offer him counter-transferentially the object relation necessary to progress. The patient cannot in this case overcome, as is demanded of him, the immense psychological distance between the two stages of the process, constituted by the infantile situation in question and present reality. Stagnation of the analysis is the result therefore of the counter-transferential rigidity of the analyst. The quantitative technique of F. Alexander (1, 2) which aims, by the manipulation of the frequency, to modify the equilibrium of the emotional participation of the patient is nothing more, basically, than an aspect of the counter-transferential interpretative attitude.

Here we may consider the role of impassibility (attitude of the "mirror") in analytic technique, in contrast with active emotional participation. When the importance of impassibility is exaggerated, a part of the analytical process is confused with the whole. In analytic technique there are two necessary attitudes of the analyst which are opposed to each other. In the first place, there is the fixed ("mirror") attitude which permits the patient liberty in the choice of the transferential situation to be developed according to the individual and temporary peculiarities of the infantile conflict. In the second place, there is the mobile attitude (interpretative) which expresses the dynamic stimulus of counter-transference. To the repetitive behavior of the patient corresponds then the *static* attitude of the analyst, who places himself in the position of a screen or mannequin. Corresponding to the potential corrective behavior of the patient is the *mobile* attitude of the analyst which is the propelling element of the analytical process. By counter-transferential mobility, which is the fundamental characteristic of psychoanalytic technique, the analyst is able to face the momentous necessities of the patient and to perform the different roles that the historic infantile drama requires. This is the "histrionic" function which naturally exists in any kind of psychotherapy but which in psychoanalysis has its maximum elasticity. In this function the analyst does not play as an actor in a theatre, a fixed role, previously established. He improvises his part, at each moment, in a constant work of creation. He is at the same time actor and author.

The emphasis which I put on the intuitive improvisation of the analyst leads naturally to the difficult problem of the definition of psychoanalysis and increases the fear that all the concepts here exposed might have as consequence an extreme dilution of psychoanalytic technique. In my opinion we cannot escape from such a difficulty if we really want to progress in theory and in practice. Besides, Freud (4) conceived of psychoanalysis as any investigation that deals with transference and resistance, taking them as points of departure. Analytic work, in accordance with predetermined rules, does fit into more definite boundaries, thus augmenting the coefficient of security. On the other hand, improvisation brings risks and uncertainty. Here we face the alternative between "planning" and "intuition" of which E. Kris (7) tells us and which gave

place to the well-known divergence between Wilhelm Reich and Theodore Reik. These are two important aspects of technique, characteristic of two opposite methods, although both correct, which we could perhaps call, respectively, "classic" psychoanalysis and "romantic" psychoanalysis. It cannot be denied that the excessive rigidity of the technical norms has greatly harmed the practical results of psychoanalysis. This justifies Reik's (11) observation of the need for the analyst to know—which is also true of the good actor—how to free himself from the tyranny of the rules learned during his academic studies.

An objection will be raised, most certainly, to the considerations here developed of the significance and importance of the counter-transference in the interpretative attitudes which put in motion the analytic process. It will be said, probably, that this is all very theoretical, complicated, difficult to understand, and incapable of practical application. I think, however, that this objection is of the same nature as the one I frequently used to hear when, in my youth, I began to be interested in psychoanalysis. It was said that psychoanalysis was confusing, vague, arbitrary, and clinically impracticable. I am convinced that only by accepting and dealing more precisely with the problem of intuitive and counter-transferential intervention will we be able to make further progress. We need to know more about the details of the intimate structure and forms of functioning of the counter-transference in order to reach a better understanding of the analytic process and in order constantly to improve the training and personal contribution of the analyst himself.

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"TRADEMARK" FUNCTION OF SYMPTOMS IN A MENTAL HOSPITAL

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In the setting of a small, psychotherapeutically oriented hospital, we have often observed one particular symptom to emerge from the patient's pathology and strikingly persist. The symptom soon becomes known by a catchword, and overtly or covertly, the patient is apt to be characterized by a slogan. The predominant symptom becomes a *carte d'identité* for the person who becomes a patient, serving to identify him to the members of the hospital community. For the patient the symptom provides a social definition of self during illness and a basis for coping with his current milieu. When a patient, his symptom and its label, become to some extent equated, it is as if the patient had a trademark—a label for a set of attributes by which he is uniformly recognized. When both staff and patients use an outstanding symptom for purposes of identification and orientation in a variety of situations, we speak of the "trademark function" of mental symptoms.

The reiterated, and often stereotyped, trademark symptom provides a dramatic basis for the exposition of processes involving orientation to, and recognition of, role and person as they occur in mental illness and in the mental hospital. In the instances we detail, mental symptoms rather than personality attributes (voice, mannerisms, style of speech, posture, etc.) serve as a provisional identity to be used as the basis for social interactions. For such patients, the symptom is not only a signal of pain or a defense, but it is transformed into a personality attribute. On the other hand, for many patients, symptoms are only a part of the range of behavior with which the patient presents himself and by which he comes to be known. In dealing with both types of patients, we find that awareness of how the patient is conceived of by the staff and awareness of how he presents himself facilitates understanding of his current interactions and difficulties. Such analysis of the processes of "recognition" reflects a cognitive and adaptive aspect inherent in the countertransference.

The stereotyped symptom, by providing a temporary identity, gives the patient the advantage of a smokescreen, under cover of which he can interact and experiment in a new environment. As he becomes better organized, there are shifts in his symptomatology, the evolution of which shows some regularity and influence of values inherent in the hospital. These observations of the trademark symptom lead to several questions. First, what is it in the fact of hospitalization and in the hospital environment, as well as in the patient, which seems to help bring about and shape the evolution of a trademark symptom? Second, what problems does the symptom pose for the hospital staff, and how can they be met? Third, what light does such a symptom throw upon the general problems of the patient's adjustment and upon the relationship of social identity to illness? With these problems in mind, we will describe trademark symptoms as observed from various vantage points in the hospital community.

Case 1. Benny became known as the "boy who killed God." An engaging, twenty year old college boy, he was admitted to the hos-

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pital following many years of psychotherapy. At the age of twelve, he presented an extensive compulsive system with rituals which served to ward off someone's impending death, usually a younger brother's. Delusions then appeared that he killed by his thought or with a breath, which proceeded to ideas that he might have killed God in the street, in the toilet, or by throwing Him out of the window. Even with these symptoms, Benny achieved scholastic and social success. On admission with these same symptoms, he participated in hospital activities fairly adequately, but would devote much time in his room to anguished ritualizing, which, for the nurses, became his trademark for a while.

Benny made his therapist feel that not discussing the thoughts behind the ritualizing, was a sign of disinterest. After vainly trying to focus with the patient on his relationships and feelings rather than on his symptoms, the therapist changed tactics and participated *ad absurdum* in Benny's sprightly interest in his delusional obsessions; they both searched streets and doorways for corpses of Benny's possible victims. After a time Benny seemed satisfied, telling his doctor on one occasion that, if observed, the two of them would be considered crazy. A period of freer exchange of feelings ensued until the patient began to take steps toward a part-time job. At this point, however, he returned to focusing on his symptoms and to ritualizing. He was neither able to pursue the job nor to acknowledge his anger and disappointment at his doctor's impending vacation and eventual departure. He greeted the resident staff apologetically, launching with eagerness, anger and plaintiveness into an account of his fears that he might have killed God. Three weeks after therapists had changed, Benny announced the contingency was past. He had squeezed his hand in anger and actually killed God, thus refuting the new therapist's expressed notion that these had been thoughts and not actions. Benny was by now generally known as the patient who thought he had killed God.

It was at this point that Benny's trademark—"Benny's the one who killed God"—was at its peak. He used it preferentially in *tête-à-tête* relations, with his therapist, with the doctor on call. He began to establish his first more intimate relationship with a female patient by telling her the details of his trademark. After this he was able to relate more actively to his therapy group by telling them his problem. Benny did not use his trademark to relate directly to the nurses or to the patient group at large.

Benny's therapist, not feeling assaulted by the patient's insistence and hidden contempt, could joke with him about his "crazy ideas"; seeing his doctor as neither omnipotent and threatened, nor impervious to irritation, Benny gradually was able to take distance. As his therapy progressed, he seemed to gain in ego facility and would resort to his trademark and other isolating mechanisms less frequently and less rigidly. Yet, he still had this resource in reserve and was delighted with himself when, on an occasion of anger, he managed to phone the police who arrived in squads to search for the reported corpses.

Case 2. Sam, a 31 year old sales engineer, was admitted to the hospital with depersonalization, hypochondriacal, phobic and anxiety symptoms dating in some form back to age eight. In prepuberty he had had fears of being shot, was shy, and concerned about his appearance. In the army, the patient developed hail-fellow-well-met and megalomanic trends; he was hospitalized after two years of service when he developed conversion symptoms after a superficial head injury.

Six years prior to admission following an unsuccessful love affair he began intermittently to experience his presenting symptoms.

On admission, the patient was tense and anxious asking questions like: "Am I

living?", "What is a house?", "Where am I?", "Why am I here?". Glad to be in the hospital, he talked to many staff members, told them his story, his doubts; reassured them of his prognosis and demanded reassurance for his panic, his fears of dying, his cardiac symptoms and perceptual distortions. He became quite angry at his therapist's "controlling his life," resenting his dependence on her. As the focal interpretation in therapy gradually came to center on the patient's fear of being overwhelmed by his feelings—of anger, of being hurt, etc.—and on his need to deny them, he began to seize more and more on one of numerous complaints which he had made: He felt numb; all he experienced was an "enormously terrible vacuum"; and finally came the affect-laden statement, "I have no feelings."

After about five or six months at the hospital this had become the one theme in relating to his therapist, to the doctor on night call—whom he demanded to see regularly—to the nurses and to his fellow patients. Whenever he was anxious or upset, or seemed to need attention, he would talk about his having "no feelings", pleadingly or angrily, hopefully or hopelessly. "I have no feelings" became his calling card, his "trademark" in the hospital; the staff well knew that Sam's the man who has no feelings and would thus speak of him in conference or when introducing student nurses to the ward roster.

A few months after the emergence of this dominant complaint there was a change in therapists. Sam occasionally referred to himself as the "hollow man" but always as suffering from "no feelings." He flooded the new therapist with such material. Genetic or dynamic or transference interpretation was of no avail; if the symptom was not discussed, the patient felt rejected. Therapists could not avoid involvement in the details of "no feelings," which involved many intriguing concretistic theories about the patient's brain. As the relationship with the new therapist became more intense, and more overtly hostile and devaluative feelings were projected on the doctor, the intensity of his symptoms decreased, only to flare up at times of crises. Both Benny and Sam used their stereotyped symptoms extensively with their therapist and the doctor on night call. In contrast to Benny, however, Sam would hold forth about his lack of feelings to groups of patients or staff. He would not reserve this for the intimate *à deux* relationships.

While these symptoms represent an identity, if a temporary one, they also identify, present and represent something of the problems, the personality characteristics, the family experience, and social capacity of these patients. Sam's trademark and his use thereof contains a reference not only to his inner emptiness and histrionics, but also to the characteristic carelessness with which he treated the feelings of others, a personality feature not unrelated to the flamboyance of outward emotion with which both his parents had overwhelmed and confused him—and the staff. The discrepancy between Benny's attitude of shy, mischievous, boyish charm and his grandiose and sacrilegious trademark was marked; how could such a nice boy do such a thing? He refrained from approaching nursing staff with his trademark just as he seemed unable directly to offend his mother with his underlying jealously and megalomania; nor, in therapy, could he link his current preoccupations with his feelings of loneliness and lack of intimacy with a mother figure yearned for and a remote and colorless father distantly critical of his masked competitiveness, contempt and inordinate ambition. Familial, genetic and intrapsychic determinants of such symptoms can be further specified with extensive social and psychiatric study (3).

We do not know in general the extent to which the emergence of such symptoms is related to basic personality rigidities, current crises and contexts or to the particu-

larities of the psychopathologic picture. In the schizophrenic patient we would expect symptoms to be related to mechanisms for handling intimacy and withdrawal, to processes for identifying and differentiating the self from others, and to the governing of the intensity of emotions. The stereotyped symptom serves these functions and seems to stand for multiple and shifting aspects of currently active basic needs rather than to represent a compromise based on well defined and bound intrapsychic conflicts. This is understandable in view of the difficulty such patients show in integrating differentiated experience into their identity and in utilizing social skills to express their emotional strivings. Precisely because the symptom serves a variety of ego functions on a variety of occasions its analysis is facilitated by examining its use in the specific situation in which it is observed. Adroitness in this process, rather than rigid rules and generalizations for therapy, is required.

INFLUENCE OF THE PSYCHOTHERAPEUTIC MILIEU

In the cases of Benny and Sam the variety of symptoms and complaints of long standing appear to have crystallized into a slogan during the course of hospitalization. In examining how the slogan evolved it seems to us that in both cases, among many levels of determinants, there is a response to the psychotherapeutic milieu.

While a brief description of the specific hospital atmosphere cannot encompass the balance and variety of relevant factors, there is clearly an emphasis upon the individual and his relationships. Many facets of hospital life tend to raise the question of how he is related; related to the hospital, to his family, to fellow patients and staff, and to himself and his own troubles. Through individual and group therapy activities, patient government, structured and *ad hoc* committees the process of evaluating and experiencing his relatedness is continuous. Some defensive operations available on the outside are either not available here or discouraged. The hospital atmosphere thus represents the need for a new adjustment. With a trademark symptom the patient has a ready means for presenting and explaining himself in an environment which, while supportive, must at times appear bewildering, if not threatening.

A trademark is also influenced and shaped in response to the psychotherapeutic interchange. In general, the therapist's demand is that the patient, with support, look at his thoughts, feelings and interpersonal relations. This is defended against by the patient's asserting the importance of "I have no feelings" or "I have actually killed God." While Sam initiated his relationship with the doctor by presenting a variety of somatic complaints, it seems that in response to the therapist's focus upon his feelings, he began to announce that he had no feelings. This is an effective though exasperating defense against a psychodynamic milieu, and at the same time, a very challenging "come-on" to the therapist; in general, the trademark serves to engage and to repulse the therapist.

Benny, perhaps feeling his delusional self-importance attacked, responded to the therapist's demand that he differentiate maturely between thought and action with the "fact" that by squeezing his hand he had actually killed God. Thus, as Benny had more occasion to identify and have identified for him a variety of meaningful experiences such as the first therapist's vacation and eventual departure, he changed the content of his symptom, sharpening its "trademark" function so that it served more adequately to defend him in a need to assert that: "I am I and I don't need you, and I'm not who you tell me I am." It served as well both to express competitive, hostile and destructive feelings and to allow progress to be made behind its facade.

In summary, the nature of both the hospital atmosphere and the psychotherapeutic

interaction at times reinforces the use of a trademark as a means of communication with or without the staff's desire or awareness.

PROBLEMS POSED IN PSYCHOTHERAPY

It is evident that a "trademark" poses a problem in psychotherapy. When it becomes the dominant and central issue, this may apparently shrink the patient's range of interaction around the symptom; the symptom now obscures the content but announces the presence of a multitude of feelings, reactions and problems. This very fact creates an impasse; by sharpening his resistance and defending his uniqueness with the trademark, the patient challenges the therapist to focus the interchange on the interpersonal, the ego-adaptive and emotional aspects of the patient's way of life. The therapist characteristically wonders if he should allow himself to be drawn into a discussion of this symptom, or try to ignore what the patient, often enough annoyingly, reiterates. It is difficult to find a way to respond to the patient's needs, permitting him to progress at his own pace, and yet to communicate that his camouflaged feelings are understood. The therapist must—as with any symptom—attempt to understand its use in communication, and to define what is "going on" between himself and the patient. He can orient himself in a given situation by observing his own and staff's response to the trademark as it is presented—interest, anger, compassion, annoyance—and by observing the patient's particular attitude and conviction in presenting the symptom. Whatever the therapist may do in the way of appreciating the multiple uses of stereotypy, we find that if he does not wrestle with the symptom, he will not reinforce it, and he can frequently unlock a current impasse by recognizing with the patient that he is annoyed, bewildered or in awe of the symptom, and thus by acknowledgment or humor reduce the current tension; a patient need not be quite so defensive in the presence of a therapist who is neither impervious, omnipotent, nor a virtuoso theoretician.

STAGES OF A "TRADEMARK"

The following two case histories will better enable us to study the various phases of a "trademark": when it begins to make its appearance, the degree of entrenchment and the variations as it reaches its heights, and finally the period when the need for its use diminishes.

Case 3. Jim, an adenoidal 18 year old, entered the hospital, a sullen and negativistic boy burdened by an imposing moustache appropriate to the king who had terrorized his household over a year, ruling his family's activities from his bedroom. His only complaint was a somatic delusion involving his testicles which led to a half-hearted attempt at self-castration with a heating pad. He initially tested the hospital staff, lying in bed, creating distance and fear, and finally by violent behavior induced a reluctant staff to control him physically. Following this staff response to the stormy episode (during which his continued stay at the hospital was in precarious balance), he felt relieved. While still remote from the staff he became comfortably engaged with his therapist until the advent of his therapist's vacation, when he set several fires, again putting the staff on edge. As he began to have extended contact through this device with the staff, it became apparent that he was bargaining for extra time and attention. When this demand was gradually met with comfortable firmness (for which, gratuitously he commended his therapist), Jim, "the maniac," abandoned an "action trademark" (*i.e.*, setting fire) and presented himself by a "verbal trademark." He now began to talk with his therapist, with the physician on night call and with some nurses about his obsessive and active homosexual thoughts toward patients and doctors, and breast sucking fantasies toward female persons. When his therapist left, he began to relate to his new therapist by tell-

ing him mainly about this one concern. Jim moved from the identity of a raving maniac, able to interact only stormily with patients and staff; to the identity of a suckling, one who was troubled with thoughts, lonesome and isolated, and sought ways of being with people from whom he wanted to receive.

This patient illustrates, as does the following, the shift from an "action trademark," which seems to correspond to a stage of greater disorganization and less ego-strength, to a "verbal trademark." This occurs at a time when his adaptive processes are strengthened and when dependency needs are acceptable enough for him to be able to interact more comfortably with the community. It may well be that the character of this transition is in part a response to the predominantly verbal rather than action values inherent in contemporary psychotherapeutic settings.

Case 4. Irene was admitted after having recovered from self-inflicted burns incurred at another hospital. A week following her admission, she regressed to an utterly disoriented, pathetic and hebephrenic Ophelia, who won sympathy and attention from both patients and staff. Confronted, after a year, with the impending termination with her first therapist, she suddenly became "aware" of the fact that she was in a hospital and had been sick, that something had happened to her. She gradually showed more organized behavior, began to participate actively and usefully in ward activities, and concomitantly, as part of her attempt to come to terms with being in the hospital, began a quest for the identity of "they," the impostors, who had put her there. "They put me here, they have injured me, and I need a detective," became a "trademark," explaining her presence, her situation and her need: the staff were to investigate in her behalf. It became the one matter about which she felt the urgent need for discussion with her therapist and the doctor on night call, or the nurse. She eventually explained to her therapist that she had to insist that her family were imposters; this related to her difficulty in accepting that such perfect people could be as malignant or idiotic as to have her confined.

Behind this development are some very effective efforts on Irene's part to consolidate herself and to effect a position *vis-a-vis* her life situation. She thus represents a point of advancement, from disorganization to contact, which demands some self-image and identity. Benny, too, initially made himself known to nursing staff and patients by his "action trademark" of ritualizing and posturing. Sam's panic and protestations contained and asked for physical action until the consolidation of his "verbal trademark."

We have observed, therefore, a stage of disorganization, regression, and ego impairment preceding the appearance of a "verbal trademark" and often associated with an "action trademark." Then comes the stage of a "verbal trademark" at a time when the patient is more accepting of his status as a patient in a hospital; he begins to incorporate this aspect into the composite of his identity and is thus forced to redefine his self-image, and with it, his "trademark." The trademark now reaches its peak in intensity and usage. Finally, in the third stage, as he is able to cope in differentiated ways, the patient seems to be gradually weaned from the symptom as a trademark, only to regress to it at times of crises such as change of therapists. These stages, we believe, correspond to different levels of stress and of ego strength.

A "TRADEMARK" AND THE HOSPITAL COMMUNITY

Physicians in the hospital encounter a "trademark" in consequence of their specific administrative and therapeutic function; in the course of dealing with "Who are you?", Why are you here?", and "How are you sick?", such an encounter is inevitable.

All other members of the hospital community will be similarly involved with the patient's symptom through its "trademark" functions. Depending on the patient's personality make-up and his perception of the nurse's role, and partly on her personality, the "trademark" will be used as a signal for nursing action, generally involving material service and touching. Benny would garner anguished sympathy from only a selected few of the staff and present his "trademark" only to them, dealing with others only about activities and issues involving his daily needs. As Sam's requests for the nurse to palpate and count pulses were firmly refused, he engaged nurses in discussion at night with "I have no feelings," and with such a needful and perplexing greeting attempted to gratify dependency needs. Adaptations in the use of the symptom can take place when the staff deals in a consistent way with the manipulative aspects of a "trademark," changing thereby the range and variety of modes by which the patient can achieve gratification. Since, in various stages of illness, a patient cannot organize sufficiently to interact around other issues and since he may be quite guilty about his overwhelming dependency needs, a "trademark" may represent the sole possible fulcrum of interaction for periods of time.

Naturally, when requests for gratification of dependency needs are so enigmatically and outlandishly cloaked, they give rise to guilt, anger and exasperation on the part of the staff. The belief that a patient is merely exploiting good will can, if shared, become a useful signal for the evaluation of the patient's needs and modes of integration. Such exasperation can also alert the staff to the ever present problem of the psychodynamic milieu: the tendency for such activity to be cloaked in meaningless slogans, a pseudoscientific pietism, or "neurosis talk" whereby the patient and staff ignore or avoid important interactions as long as whatever occurs is "therapeutic." A patient, when improved, can use a trademark to justify exploitation of his dependent position in the hospital: "As long as I talk about my feelings I don't have to do anything about my problems." This presents a problem to the entire staff, calling for an overall evaluation of everyone's approach to such patients and of the current tone of the general milieu, an evaluation hampered by stereotypy of symptom, interaction, or interpretation.

A trademark is used in patient interactions as well as in staff-patient relationships. Jim initiated intimate relationships by approaching individual patients with his cardinal symptom, after first discussing his homosexual concerns with staff. His therapy group which—without analyzing it—had assessed his poor control and condemned his fire setting, then began to respond to his as a verbally relating person by permitting discussion of his chief concern.

Irene, at first shy and vague in the therapy group, finally did discuss herself by presenting her "trademark" which astounded and fascinated the group. They inquired into the story of her imposters, but as her insistence and vagueness became irritating, they recognized with her that she had had an overwhelming experience, but told her they could not go along with her delusions. She nevertheless was accepted and for a time learned to separate what was acceptable and what both group and staff saw as poignantly real to her but crazy.

Benny, who had long reserved his "trademark" for selected staff, employed it next with two young women to initiate a relationship of intimacy, and then discussed it in the therapy group, a group to which Sam had early divulged his symptom of "no feelings." They quickly remarked the affect with which the impulsive and histrionic Sam reiterated his complaint, and focused with Benny on his current behavior.

Thus in the group a patient's "trademark" is presented according to the needs

and temperament of each patient. It is greeted with empathy, irritation, humor, and interpretation; and dealt with frequently in a manner which reinforces the general therapeutic program. It is not an uncommon experience to learn from the patient's interactions with other patients and with the staff, what the psychotherapist alone may fail to discern.

GENERAL ASPECTS OF A "TRADEMARK"

A trademark identifies, characterizes, and labels a patient. Such labelling and locating is fundamentally determined by a general need to orient, to select the relevant aspects of a situation in preparation for response (2). In this sense, the need may comprise perception of social roles, particular relationships and emotional needs. The tendency to endow perceptions with value—rather than to make judgments of value—to perceive in terms of good and bad, like and dislike, also enters into such orienting identifications. The simplest means of orienting and identifying persons lies in naming them. Social interactions are also initiated with reliable orienting by uniforms and cards, as any motorist apprehended for speeding knows. Gesture and posture have been studied in these respects (4), and, as we have seen, mental symptoms can serve to orient. In general, in order to think of or refer to a person, beyond naming him, one tends to select certain salient characteristics of that person, his role, or one's past or anticipated experience with him. Similarly, the person in question tends to present certain traits and features as salient. Labelling or characterizing is a two-way process comprising an emotional and cognitive interchange between what is offered for labelling and what is responded to. Labelling is also a function of the group for, or to whom, the person is being labelled. A university professor will be introduced as "Joe" in a party of close friends, whereas at a public lecture he will be labelled in the more general terms of his profession and his qualifications to talk about a given topic: "Professor Joseph Doe, Lecturer in Economics, a man who..." Such labelling identifies to a group of people who a person is, and why he is here. These are the same questions which, explicitly or implicitly a patient admitted to a mental hospital is called upon to answer and which he may answer repeatedly with the use of a single mental symptom throughout a wide range of social interactions.

Though this is an area for systematic scrutiny, it is our impression that these processes of identifying, labelling and characterizing can be discerned at various developmental stages (1, 5). Two and three years olds use names to identify both themselves and their peers. Just as our patients cling desperately to the trademark to indicate who and what they are, these children are intolerant and quite sensitive to changes in names, even if accidentally introduced. They also react with sensitivity to any change in accustomed patterns of behavior. For example, Johnny regularly cried when his mother left in the Nursery School; the first time that he successfully fought his tears, another child in some panic asked the teacher: "What's wrong with Johnny?" These children seem to rely on the stability of names and unverbalized behavioral patterns in order to characterize and identify those around them; Johnny was not called a cry-baby, but his crying was obviously identified as a stable and characteristic feature. They are at an "action" stage of characterizing, but soon shift into a stage in which they are willing to experiment with both names and characterizations, *i.e.*, with roles, both for themselves and others. They now tolerate some manipulation in their names and identifications and can afford some play with respect to "who and what" they are. When they have become adults, they must inevitably rely on oversimplified criteria in orienting, but we would ideally expect that

the adult will be flexible in perception and judgment and responsive to a wide range of relevant features when he characterizes.

Among children of the ages 9–11, the use of nicknames seems particularly conspicuous. Such nicknames may relate to physical characteristics (Shorty, Red), or certain behavioral traits (Sunny, Chief). Often, nicknames originally derive from a child's parents or from names enunciated by siblings at an early age. Here, too, both the child and his parents are mutually involved in creating such a name, which—often enough—is a prescription for a role to be followed. This age group, then, is at a verbal stage of characterizing.

Labelling, pet names, and nicknames, often self-chosen, turn up again in adolescence, where numerous social and personality roles are explored in the quest for a stable identity. Pet names occurring in the hospital invariably reveal staff participation in role definition as well as fundamental aspects of the patient's problems in identification and identity.

Case 5. Eva, a 23 year old violinist, turned to shouting her share in interview, becoming known as the "Screamer," frightening those who would approach her. She was nicknamed "Dolly" by the nurses who appeared thus to be attempting to detoxify what was difficult to bear. "Dolly" did describe a preferential role: Eva in her moods of coy coziness, cutely seeking out nurses for help with domestic chores and "womanly" affairs. A successful and vivacious, though compliant child, she had been a "model" in the community, pleasing her mother; the latter was by many descriptions an "angel," whose appallingly Spartan self-sacrifice made intimacy and assertion of feminine identity no longer possible for Eva. As "Dolly" she sought to achieve intimacy and identity; experiencing frustration, guilt and inferiority she withdrew in panic to shout proof of her independence and individuality, and began invariably to introduce herself to new patients with these scenes.

These processes of identifying, localizing and characterizing oneself and others are used to orient oneself in a variety of social situations. They may be used transiently, *e.g.*, in the ordinary course of development or in any new situation; less flexibly used, they may form the nucleus for more enduring patterns of social and personal behavior. When these orienting features are transformed into a rigidly encysted structure and attached to a mental symptom, this becomes a substitute for a stable internalized identity. We conceive of a "trademark" in the mental patient as such a structure.

CONCLUSIONS

We have observed that certain stereotyped symptoms in mental patients have a trademark function in that the symptom becomes a personality attribute serving both as a provisional identity and as a basis for current social interactions. Such symptoms are used as the defensive, restitutive and expressive basis both for a variety of intrapsychic strivings and for a variety of communications and relationships within the hospital. The "trademark's" specific characteristics seem to depend in part on the dynamic, integrative and interpersonal status of the patient and in part on the social system to which he is related. Through the symptom the patient orients himself and others in his milieu to his current status. We would expect that scrutiny of orienting behavior in any patient would reveal important aspects of the treatment transaction, and of the relationship of personality and of identity to illness.

Because of the rapidly changing sociopsychological processes and roles which mental illness entails, the need for orienting mechanisms is intense. The hospital sanctions and completes the psychosocial disruption represented by illness by identifying the person as a mental patient. Both for the patient and for his family, the hospital serves to mediate a transition and to

integrate a new and temporary role by granting a psychosocial moratorium. We have observed the "trademark" function of symptoms in this context, and noted its fluctuations as the patient is dealt with and with changes in his mental status. The patient's reiteration of who he is and why he is here may occur most sharply as his identity diffusion diminishes and as a more organized and wider basis of experiencing becomes tentatively available. The cardinal symptom may be of a delusional nature. The patient's delusional and stereotyped formulation does not necessarily represent stereotypy of experiencing. It does represent an assertion of uniqueness and an adaptive maneuver—at times a smokescreen—whereby he can to some degree control his experience and influence his environment. Precisely because a single symptom is employed for a variety of functions, its analysis depends on scrutiny of current interactions as well as comprehension of genetic factors.

Since a "trademark" is also a means of emotional communication with others, it engenders strong emotional responses on the part of the staff, who, like the patient, need to evaluate, locate and orient themselves and others. This continuous and inevitable emotional and cognitive response can, as all countertransference, serve as a barrier or as an opening to increased understanding of the patient.

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BRIEF COMMUNICATION

SEX CYTOLOGY IN SCHIZOPHRENIA

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In the search for constitutional or metabolic factors in schizophrenia, influences at the cellular level may have significance. One such cellular property to come to general attention is the demonstration by Barr of a sex difference in somatic cells. It is necessary to evaluate this feature of the somatic cells of schizophrenic patients because of the severe confusion regarding sexual identity frequently seen in schizophrenia.

Since 1949 Barr and others (1–11) have demonstrated the presence of a small planoconvex intranuclear chromatin mass in somatic cells, which they refer to as the nuclear satellite. It is located at the nuclear membrane in 30 to 80 per cent of intermitotic nuclei of the somatic cells of females, whereas it is present in only 2 to 13 per cent of such cells in males. This difference, first detected in the nervous system of the cat, has been found in most organs of many mammals, including man.

Barr's hypothesis for this cytological variation in the sexes is based on the differences in the chromosomal pattern of males and females. His explanation is that the chromatin mass is derived from the heteropyknotic portions of the two X chromosomes while the combination of the XY chromosomes is too small to be seen at the resolution of the light microscope. Direct evidence to support this hypothesis is presented by Reitalu (22) who demonstrated that the nuclear satellite migrates and divides during mitosis to become what is recognized in the mitotic cell as the X chromosomes. Indirect evidence is found first in the knowledge that the mass contains desoxyribonucleic acid as demonstrated by the Feulgen stain and is therefore, in all likelihood, genetic material. Secondly, sex chromosomes can form chromocentres when the autosomes do not, thus excluding the possibility that the nuclear satellite is an autosome (13). In *Microtus agrestis* (vole) which has unusually large sex chromosomes compared with its autosomes, the somatic nuclei have proportionately enlarged chromocentres (13). Cases cytologically diagnosed as males may display recessive sex-linked hereditary characteristics which confirms there being only one X chromosome and demonstrates the reliability of the diagnosis (13, 21).

This cytological difference in the nuclei of cells of the two sexes has had application in the following clinical studies:

1. In the evaluation of syndromes where sexual ambiguities exist such as Klinefelter's syndrome, ovarian agenesis, and other gonadal dysgeneses. Many authors have reported in these cases discrepancies between the sex-chromatin evaluation and the genital phenotype.

2. "Nuclear sexing" has also had application in neoplasms where it was found that in general the tumors had the same sex chromatin pattern as the host with the exception of teratomas in males. The nuclear satellite often could not be distinguished from other chromatin masses present in the malignant cell, making sexing of the tumor difficult and sometimes impossible. Benign tumors were found to have normal sex chromatin morphology.

3. The prediction of human fetal sex can be one hundred per cent accurate as determined from the cells of amniotic fluid from 12 weeks to full term.

4. The relationship between psychosex-

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uality and chromosomal sex has been investigated by Money *et al* (16–19). They find, in cases where sexual ambiguity exists, the single most important influence in the establishment of the gender role (patient's own sexual identification) is the environment. The next most important influence is the appearance of the genitalia and the secondary sex structures and the least important is the chromosomal sex. They found if an attempt is made to change the gender role after the early months of life, even if these changes are consistent with the somatic sex as determined by Barr's method, frequently mental confusion and psychic damage results.

Two hundred and sixty-four male homosexual cases were studied by Pare (20) and normal male sex cytology occurred in one hundred per cent of these cases. Pare quotes Lang's work (Munich, 1936) as a reason for investigating the sex chromatin pattern of homosexuals. Lang suggested that some male homosexuals are genetically female but have lost all their morphological characteristics. In testing this hypothesis by investigating the sex ratio of the siblings of over 1,000 homosexuals, Lang found the ratio to be 121 males to 100 females. The normal ratio is 105 to 100. His work apparently was not consistently substantiated in smaller studies by others. Lang concluded that this finding could be accounted for if some of his male homosexuals were genotypically female, but the hypothesis was not confirmed by the sex chromatin technic.

Transvestism has been studied (10, 12) by the sex chromatin method in 14 reported cases (ten males, four females) with the idea that it represents an extreme behavioral type of intersexuality. However, no variation from the normal was found.

A search of the literature has failed to reveal any investigation of schizophrenia from this standpoint. For this reason, the present study was undertaken.

METHOD

Oral smears, taken from 36 normal adults (26 women, ten men) served as controls. The experimental group consisted of ten female schizophrenic patients from 23–48 years of age and ten male schizophrenics from 27–51 years of age. The duration of illness for the two groups respectively ranged from 1 to 14 months and 2 months to 21 years.

All smears were fixed and then stained with cresyl echt violet according to the technique described by Moore and Barr (15).

The percentage of cells with the nuclear satellite present was determined in each specimen by counting 100 cells and on some occasions as many as 500 cells. It has been claimed that 25 cells per specimen are sufficient for significant results (14).

RESULTS

Table 1 demonstrates that there was no significant difference in the per cent of cells with the nuclear satellite in the control and

TABLE 1

Summary of Results: Control and Experimental Groups

Group		No.	Age		Duration of illness		Race	% of Cells with Sex Chromatin	
			Aver.	Range	Aver.	Range		Aver.	Range
Male	Control	10	30	24–40	—	—	9 White, 1 Negro	3	1–8
	Schizophrenic	11	36	27–51	4½ yrs.	2 mos. to 21 yrs.	11 White	2	0–5
Female	Control	26	35	20–50	—	—	22 White, 4 Negro	29	13–48
	Schizophrenic	10	32	23–48	1 yr. 2 mos.	1 mo. to 3 yrs.	8 White, 1 Negro 1 Oriental	35	19–49

schizophrenic groups. The average for the male control group was 3 per cent; for the male schizophrenics 2 per cent; for the female controls 29 per cent; and for the female schizophrenics 35 per cent.

DISCUSSION

The results demonstrate unambiguously that the sex chromatin pattern in schizophrenic patients is no different from the pattern in non-schizophrenic controls. The findings are similar to the data found in the studies of homosexuals and transvestites and agrees with the hypothesis that psychosexual abnormalities, predominantly of psychic and behavioral nature do not show aberration in the sex chromatin pattern, in contrast to many of the physical syndromes involving the reproductive tract and secondary sexual structures.

The staining technique finally adopted was chosen, after a trial of several, including the Feulgen, on the basis of technical convenience and optimal visualization of the satellite body. Although the percentage of nuclear satellite-containing cells found in females is somewhat lower than those reported by Moore and Barr (15) for reasons that are not apparent, they are in good agreement with those obtained by Dixon and Torr (3, 14). Despite the difference that exists between Moore and Barr's data and ours, there exists no overlap in distribution between males and females of either the schizophrenic or control groups in this study.

SUMMARY

The sex chromatin content of somatic cells of schizophrenic patients was investigated and found to be the same as found in nonschizophrenic controls. A review of the literature on sex cytology in somatic cells was made including its relationship with somatic sexual abnormalities, neoplasms, prediction of fetal sex, and behavioral sexual ambiguities. This review also presents the histochemical and genetic evidence currently explaining the normal sex chromatin distribution. From our own study and the review of the literature it appears that conditions known largely by their psychological and behavioral features, such as transvestism, homosexuality, and schizophrenia, have no connection with the sex chromatin pattern.

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BRIEF COMMUNICATION

STUDIES ON SCHIZOPHRENIA IV: THE "GLYOXYLIC ACID" REACTION ON THE URINES OF SCHIZOPHRENIC AND OTHER PSYCHOSES

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In continuation of former work on the disturbance of the albumin-globulin ratio in the C.S.F. and sera of schizophrenic patients, carried out by workers in this laboratory (5, 7) and influenced by the observations of Hoffer *et al.* (10, 17) that many of the substances producing so-called model psychoses contain an indole ring, Riegelhaupt (19) applied the glyoxylic acid (Hopkins-Cole) reaction to the urine of schizophrenic and other psychotics, neurotics and normals. He found positive reactions in most schizophrenics and a small number of other organic psychoses. In normal, neurotic and cyclothymic conditions the reaction was usually negative. It was thought that the positive reaction was due to a substance with an indole nucleus other than indole, possibly tryptophan or its metabolites. It is clear that more detailed information cannot be obtained by this simple test. But paper chromatographic studies by other authors are still at variance, or not of a really qualitative nature (6, 8, 11, 14, 15, 16, 18, 20). The reaction used by Riegelhaupt therefore retains its value as a screening test, and a number of additional studies have been carried out.

IMPROVEMENT OF THE TECHNIQUE

Riegelhaupt (19) originally applied the test as a ring test. However, although Riegelhaupt has attempted other improvements of the original technique (20) the small surface of the ring frequently makes the observation of the color difficult and the following technique is now used:

To 2 ml of urine (specific gravity as near as possible to 1.010) 1 ml of water, (or 1 ml of glyoxylic acid reagent (12) or 1 ml of suitable glacial acetic acid (1)) and 0.1 ml of a 2.6% Cu SO_4 solution (1, 12) are added and well mixed. The test tube is immersed in a sloping position in cold water (4) and 1 ml of concentrated H_2SO_4 is allowed to flow in within 30 to 40 seconds. The color of the ring is observed and the tube replaced in the water. One minute after the addition of the H_2SO_4 has been completed, the mixture is thoroughly stirred, the tube removed from the water and the color noted immediately, after five minutes and after 20 minutes. Two ml of chloroform are now added, the mixture is vigorously shaken for 15 to 20 seconds and centrifuged. The color of the chloroform and supernatant layers are noted and the latter is compared with that of the 20 minute reading. Evaluation of the reaction (after the 20 minutes reading): mauve or pink: +, mauve or pink with slight addition of brown: weak +, brown or essentially brown: negative. Some drugs like Largactil or paraldehyde may interfere with the colors of the reaction; very dilute urines may provide false positive, very highly concentrated urines false negative reactions.

INFLUENCE OF INDICAN ON THE REACTION

Riegelhaupt has noted (19) that constipation does not appear to affect the outcome of the test, implying that indican may not influence the reaction. It was decided to examine this problem more closely. In order

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to detect small quantities of indican, only 0.5 ml of chloroform was added to 4 ml of a urine-Obermeyer reagent mixture and the mixture vigorously shaken and centrifuged. Also, to urines on which the Adamkiewicz or Hopkins-Cole test had been performed, chloroform (0.5 ml) was added. The color and the intensity of color of the chloroform agreed, as a rule, with that given by the Obermeyer test. Urines with quite a strong Adamkiewicz or Hopkins-Cole reaction often do not contain appreciable amounts of indican or choroform-extractable pigments, while urines containing marked amounts of indican give often quite negative Adamkiewicz or Hopkins-Cole reactions. In principle, then, the color of these two reactions is not caused by indican. There was, however, a small number of urines from constipated normals and patients which contained an excessive amount of indican, and in these the Adamkiewicz and Hopkins-Cole reactions gave sometimes very strong blue-mauve colors. In such cases extraction with chloroform does not render a brown but a red-pink supernatant. It appears, therefore, advisable to disregard positive reactions in the presence of great excess of indican.

In the actual test, as described above, 2 ml of chloroform are added, in order to ensure the extraction of all or most of the indican or indicanoid substances.

BEHAVIOR OF SMALL CONCENTRATIONS OF DL-TRYPTOPHAN, PROTEIN-BOUND AND FREE, IN WATERY SOLUTIONS AND URINES

Riegelhaupt (19) reported that the glyoxylic acid reaction is independent of small amounts of protein in urine. This is due to the experimental conditions: a 100 mg % solution of γ globulin in saline will at first give practically no reaction. With albumin still higher concentrations remain practically negative for the first 10 to 15 minutes. Afterwards, a faint color appears which increases very slowly. When, however, equal parts of the protein solution and glyoxylic acid (or water) are taken, and the test tube is allowed to stand in the rack while an aliquot of H_2SO_4 is being run in, a 10 mg. % solution of globulin will give a faint green ring and after stirring turn a faint pink; for albumin again higher concentrations are necessary.

With small amounts of dl-tryptophan dissolved in slightly acidified water the Hopkins-Cole reaction may remain negative or be only very faintly positive under the conditions of Riegelhaupt's technique. If a ring is seen, it shows often a greenish-yellow color; after stirring, the color of the solution may appear water clear, or it may very slowly turn yellow-green, brown, pink, mauve, violet or nearly blue according to the concentration of tryptophan present. Differences in color, according to the strength of protein solutions were already seen by Adamkiewicz (1); but in positive urines the typical color comes up very quickly and, later on, disappears. The behavior of the reaction with positive urines is therefore entirely different from that with watery tryptophan solutions. The following was also noticed: If a 1 g % solution of dl-tryptophan is prepared in water by acidification with only a few drops of concentrated H_2SO_4 and left on the bench for a day or two, the solution becomes red-pink (this is usually less pronounced when HCl is being used for acidification), and when such a slightly colored solution is diluted to 100 mg % or less and the reaction then applied, the ensuing colors are stronger than when a solution of corresponding concentration is initially unstained; also after stirring the color develops rather quickly. It essentially behaves as urines do.

Positive urines may contain also one or several catalysts of the tryptophan reaction: when small amounts of tryptophan are added to positive or negative urines, then in positive urines the additional color is much stronger and develops much more quickly than would have been the case in a

pure watery solution of tryptophan. In view of all these facts it appears that a positive reaction in urine is not necessarily caused simply by an excessive excretion of free tryptophan.

APPLICATION OF THE REACTION TO SERA AND C.S.F.'S

Attempts at obtaining a positive reaction on sera (dilution 1/2 to 1/200) and a few C.S.F.'s were unsuccessful, whether the fluids came from urine-positive or negative patients.

THE REACTION IN CONDITIONS OTHER THAN SCHIZOPHRENIA

It had already been noted (19) that urines of some patients with organic psychoses gave positive reactions, and, the same occurred very occasionally in neurotic or cyclic disorders. Later on, we observed that some g.a. negative members of the laboratory staff gave positive reactions when they had infections such as colds or 'flus. A positive reaction was also seen in some mentally normals suffering from cystitis, but a few normal persons with cystitis gave negative reactions. With the disappearance of the infections the reaction became negative again. It is also possible that the intake of alcohol produces a positive reaction.

Positive reactions were frequently obtained in patients suffering from organic dementia, hypertensive as well as senile, epilepsy, apparently particularly of the idiopathic type, Huntington's Chorea, Post-encephalitic Parkinsonism, Paralysis agitans, in one case of Sydenham's Chorea, one with pernicious anemia and another with carcinoma of the lung, who at the same time, however, had an excessive amount of indican in his urine.

DISCUSSION

As the reaction was positive not only in most idiopathic schizophrenic patients but also in quite a number of patients suffering from organic cerebral and general diseases, and also in normals afflicted with acute infections, there is no doubt that it cannot be more than characteristic of idiopathic schizophrenia. The results may be analogous to those of Leach *et al.* (13) on the oxidation of epinephrine by the serum of schizophrenic and other patients, and also to the work of the Heilmeyer school (2, 3, 9, 18) on the copper content of the serum in psychotic and other conditions, when an increased serum copper in schizophrenics and also a number of organic diseases was found and, in contrast to our results, in manic-depressive psychoses (9). It appears possible from all this that the metabolic disorders found by us and other workers are due to a disturbance of systems involving *also* central nervous regulatory structures. Consequently, the significance of the reaction with regard to the pathogenesis of schizophrenia still requires clarification.

SUMMARY

The modification of the Adamkiewicz-Hopkins-Cole reaction on urine described in this paper has been shown to be positive in most idiopathic schizophrenics and a number of organic psychotic and non-psychotic conditions. It is not positive in normals, nor in various neurotic and cyclothymic patients when they are physically healthy. A positive reaction is characteristic of but not specific for idiopathic schizophrenia.

The positive reaction is essentially independent of an increase of indican in the urine.

The positive reaction is probably due to a disturbance of tryptophan metabolism, possibly combined with the presence of catalysts in the urine. The exact nature of the substance or substances producing a positive reaction is unknown.

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BRIEF COMMUNICATION

PROGRESSIVE SPINAL MUSCULAR ATROPHY: REPORT OF A CASE WITH ONSET IN INFANCY AND SURVIVAL TO ADULTHOOD[1]

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The progressive spinal muscular atrophies include a group of related disorders which may have their onset either in infancy or adulthood. It is unusual for cases occurring in infancy to survive to adulthood (1, 2). The purpose of this communication is to report an unusual and possibly unique case of a fifty-year-old patient with progressive spinal muscular atrophy believed to have had its onset in infancy.

CASE REPORT

This fifty-year-old white male was seen at the Medical Center for Federal Prisoners at Springfield, Missouri in January of 1954. The patient was one of six children. One of his brothers has epilepsy and another was described as being feeble-minded. No other family history of neurological disease was obtained. The patient was married and had four children of his own, all of whom were reputed to be normal and enjoying good health.

The early history obtained from the patient as it had been told to him by his parents, revealed that he had appeared perfectly normal at birth. At the age of ten months both of his legs became paralyzed within the course of a few weeks. The upper extremities did not appear to be affected. Infections on the right shoulder and behind the left knee, described as "carbuncles", were also observed at this same time. Apparently no other evidence of systemic illness was observed. In fact the family, who resided in rural Kentucky, did not seek any medical attention for the patient.

Following infancy, the patient's lower extremities remained paralyzed and underdeveloped. Although he never learned to walk he did manage to get around on his hands and knees and has continued to ambulate in this manner.

The patient denied any history of seizures or of any visual, sensory, or sphincter disturbances. However, about twenty years ago he became aware of a slight weakness in his hands and arms. Thereafter he noted slow progression in this condition with gradual wasting of the muscles of his hands and forearms. The patient appeared to be well-adjusted to his deformities and stated that he had never sought medical attention. He made no significant complaint at the time of this examination. Despite his severe handicap he had been able to earn a living by farming and doing odd jobs.

At examination the patient was found to be cheerful and cooperative. He ambulated on his hands and knees, wearing gloves and knee-pads. While crawling in this manner he hooked the left foot over the right ankle to prevent it from dragging (See Figure 1).

Examination of the cranial nerves was unremarkable except for a slightly hyperactive jaw jerk. There appeared to be massive developments of the musculature of the arms, shoulder-girdle, and chest. However, close inspection revealed some spotty wasting of muscle bundles which was most marked in the hands and forearms. The circumference of the left wrist was

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found to be one inch less than that of the right. There was some wasting of the intrinsic musculature of the hands, most marked in the thenar and hypo-thenar eminences of the left hand. There was weakness in the grip in both hands, more marked on the left. Coarse fasciculations of the muscles of the chest, shoulders, upper arms and abdomen were observed and they could also be palpated.

There was a flaccid paralysis of the lower extremities with accompanying atrophy. Voluntary motor function in the lower extremities was limited to weak extension and flexion of the right foot, weak flexion of the knee and hip on the right, and only weak flexion of the hip on the left. The patient was unable to extend the right leg at the knee or the hip and he was unable to carry out any extension movements in the left leg. Passive motion in the knee joints was limited so that neither knee could be extended beyond 95 degrees.

The deep tendon reflexes in the upper extremities, and the pectoral reflexes were bilaterally equal and moderately hyperactive. With the exception of the right ankle jerk, the deep tendon reflexes were absent in the lower extremities. The abdominal and cremasteric reflexes appeared to be physiological. The Babinski responses were negative. Sensation was found to be normal in all modalities. The patient performed coordination tests satisfactorily with the upper extremities. Coordination in the lower extremities could not be tested because of the flaccid paralysis.

Laboratory examinations of the blood and urine were non-contributory. Serological examination was negative. Spinal fluid pressure and dynamics were found to be physiological. Examination of the spinal fluid showed it to be within normal limits.

X-ray studies revealed deformities of the legs, spine, and pelvis which were felt to be secondary to muscular and postural abnormalities. There was no evidence of spina-bifida or any other bony anomaly

FIG. 1. Showing musculature and characteristic means of ambulation of the patient.

which could account for the paralysis of the lower extremities. X-rays of the skull and cervical spine did not reveal significant abnormalities. The chest plate was clear.

Under electrical stimulation the muscles supplied by the cranial nerves responded normally. Faradic stimulation produced vermicular contractions in most muscles of the upper extremities. Galvanic stimulation of the musculature of the upper extremities produced responses indicating partial or complete reaction of degeneration in most instances. In the lower extremities there was no response to electrical stimulation, except in the gluteus muscles which showed reaction of degeneration.

COMMENT

This patient has chronic anterior horn-cell disease, which is distributed widely throughout the spinal cord. The history of progression and the finding of fasciculations and partial reaction of degeneration indicate that the disease is still active in the cervical and thoracic segments of the cord. With the exception of the gluteal innervation, the process seems to be quiescent in the lumbar and sacral cord.

Several possibilities must be considered in establishing the diagnosis in this case. For instance, it is possible that the patient's legs were paralyzed from birth and that the defect was not noticed until he was expected to stand and walk. However, the history obtained, though admittedly inadequate, does not support this view. It is also pos-

sible that the patient may have been crippled in infancy by poliomyelitis and that the progressive spinal muscular atrophy which he now appears to have, was a later development. We feel that the X-ray studies of the spine have ruled out spina bifida and cervical spondylosis as a possible cause for his condition (3). In the differential diagnosis one must also consider such conditions as amyotrophic-lateral-sclerosis, Charcot-Marie-Tooth peroneal muscular atrophy, and Gower's distal muscular dystrophy.

This case does not appear to conform entirely to any classification. The history and the current clinical features suggest both infantile and adult forms of progressive spinal muscular atrophy. Thus the case may represent a link between the two entities.

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